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THE CHOLAM MITE†

(*Paratetranychus indicus on Sorghum*)

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Introduction. Next to paddy (*Oryza sativa*), cholam (*Sorghum*) is the most important cereal in the Madras Presidency.* It is subject to a variety of pests such as the earhead bug (*Calocoris angustatus*), the shoot bug (*Pundaluoya simplicia*), the stem borer (*Chilo simplex*), the Deccan grasshopper (*Colemania sphenarioides*) and the mite (*Paratetranychus indicus*). The present paper deals with certain observations made on the life history and remedial measures tried in regard to the last named, namely the cholam mite.

Description of the mite. The cholam mite belongs to family ***Tetranychidae* the members of which are commonly known as "red spiders". The general appearance of the mite as seen under the microscope is shown in figures 1 and 2. The general colour of the mite is greyish green. Generally the males have also a slight tinge of red. In addition to this difference in colour the males may also be distinguished by their smaller size. The males are about 0·3 mm. long and the females about 0·5 mm. long. Further the tip of the abdomen of the male is pointed while it is more rounded in the female. Mr. Hirst of the British Museum to whom the specimens were sent for identification described it as a new species in the *Proceedings of the Zoological Society of London*, Part IV December 1923.

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† Paper read before the Indian Science Congress, 1932.

* For the year 1930—31, out of a total of 25,666,722 acres under Cereals paddy came first with 11,677,529 acres and cholam second with 4,7,209 acres.

** The classification followed is that of Nathan Banks.

Life History. There are four stages in the life history of the mite viz., the egg, the larva, the nymph and the adult.

Eggs are spherical in shape and white. The diameter of an egg is about 0·12 mm. A day before hatching the colour of the egg changes to dark-red. The egg stage lasts 3 to 4 days. One female which began egg laying on 6th February 1924 but escaped on 21st February, laid 63 eggs distributed over 16 days, the maximum being 9, the minimum 1 and the average 4 per day. The maximum number for a day in the case of another individual was 19 eggs.

Larvae. The larvae which hatch out of the eggs are pale white in colour. They have three pairs of legs only, in contrast to the nymphs and adults which have four pairs. Eyes are present and are reddish in colour. The larvae feed on plant sap and in two to four days moult into nymphs.

Nymphs. Nymphs very much resemble the adults. Both have four pairs of legs and are rusty green in colour. But in size the nymph is smaller than the adult. As soon as the nymphs emerge they begin to feed. In about two days they become quiescent, stop feeding and then moult. This is the first moult. After this they feed for two days more and moult a second time. After the second moult they are no longer nymphs but adults. When moulting, the skin is ruptured transversely and the line of rupture is the groove between the cephalothorax and the abdomen.

Adults. As stated above the adult stage is reached after the second nymphal moult. In a day or two the females begin egg laying either after copulation * or without copulation. The whole life cycle lasts 9 to 12 days.

Parthenogenesis. In the course of examination of a number of mite-affected plants it was found that there was a preponderance of males over females in the case of a few plants. This led the writer to suspect the phenomenon of "Parthenogenesis" i. e. reproduction without the intervention of the male. Experiments were therefore devised to test this. It was found that the usual method of introducing a cholam leaf within a glass chimney and closing both ends with cotton wool did not prove useful as the mites often wandered away and were lost in the wool. The following method tried by the writer gave satisfactory results.

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* Mr. Wood-Mason describes the act of copulation in detail in the case of *Tetranychus bioculatus*. a red-spider mite on Tea in his "Report on the Tea mite and Tea bug of Assam 1884" which is applicable in this case also.

A glass basin 6 inches in diameter was filled with water. Another smaller basin about 3 inches in diameter was filled with soil and a cholam seedling planted in it. This was then placed inside the bigger basin with water. The whole thing was then covered with a glass chimney about 2 ft. high and 1 ft. in diameter. the upper portion being tied with muslin for aeration. A mite egg (not known whether it was fertilised or not) was introduced on the cholam leaf by means of a fine brush. A female was reared from this egg. Though no male could have access to this female, due to the water in the bigger basin, she laid eggs from which both males and females were reared out parthenogenetically. One of the females of this generation again laid eggs from which both males and females were got parthenogenetically. In the next generation however all the progeny of one of the females selected happened to be males.

Nature and symptoms of damage. The injury caused to the plants by mites is quite comparable to that of the plant bugs (*Rhynchota*) since in both cases, plant sap is sucked out. As a result of their attack, the cholam leaves turn bright red in colour and ultimately dry up. The infestation starts at different centres on the leaf and gradually spreads out from these. In the field also small patches of attack are first noticeable on plants at a few centres and these gradually enlarge and the infestation spreads in all directions.

At first sight the red patches produced by mites are liable to be mistaken for patches caused by the sorghum 'rust'. But on closer examination it is seen that the mite patches are bigger in size than the rust patches and that they can be easily distinguished by the presence, on the lower surfaces of the leaves, of a delicate web under which thousands of minute creatures in all stages of development could be seen together with their white moult skins. In a few cases mites have been noticed on the upper sides of the leaves also, but this is rather the exception than the rule

Method of spread. In the field, leaves of neighbouring sorghum plants would touch one another and it is only natural that the mites should travel from the dry leaves to the green. If the plants are not touching one another the mites descend to the soil and travel over of until they reach fresh plants. Stabler * has made the observation t ope mites in the case of fruit trees are distributed by the agency of w attle It is possible that in the case of the cholam mite also strong at the covered may be one of the means of dispersal. This will be tested in the coming season.

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* Stabler (H. P.) "Red spider spread by winds". Monthly Bull. Sta 3w. Hortic. Sacraments. Cal. ii, No. 12, Dec. 1913, pp

Amount of loss. In the Central Farm, Coimbatore, the amount of loss due to mites may roughly be estimated at 5%. In 1909 the attack was so severe in one of the fields that the whole crop had to be destroyed. There are records to show that in Vellore and Salem there was considerable damage to the cholam crop due to the mites in certain years.

The amount of loss seems to depend on the age of plants. If the attack begins when the plants are tender they may not yield any earheads at all or even if earheads are produced they will be very small in size. If the infestation appears in the later stages of the crop there may not be much damage done to the earheads, but the leaves of attacked plants do not seem to be much relished by cattle.

Distribution in the Madras Presidency. In the Coimbatore district mites are found both in the *Chitrai cholam* (irrigated) and *Periamanjal cholam* (rain-fed). The former is sown sometime in the middle of March and harvested in June and the latter is sown in August and harvested in December. It is mostly in the irrigated crop between March and June that mites are noticed in large numbers. In Bellary they are found from December to March. In Salem, Chittoor and North Arcot districts also there are reports of mite damage.

Alternate food plants. In regard to the Central Farm, Coimbatore, the question of alternate host plants does not arise at all. One field or other is sure to have the cholam crop, grown either for grain or for fodder throughout the year. It is only natural that the mites should find shelter in some of these crops ready to attack the next. Because of the continuous growing of the crop the number of generations of the mites also may be large. A search was however made for alternate host plants and as a result the writer was able to collect a few mites from *Panicum javanicum and Panicum distachyum*, two common grasses found on field bunds.

Effect of weather conditions on mites. It is found by experience that during dry hot weather mites generally thrive and that heavy rains seem to be inimical to them.

Natural enemies. Six different natural enemies have been noted till now, five being insects and one a mite. Life histories of these are briefly given below:—

1. *Scymnus gracilis*, Motsch. (Fig. 3). This Coccinellid is the most ortant enemy of the cholam mite. Both grubs and adults feed on eggs and occasionally also on larvae and nymphs.

he female beetle after mating lays eggs singly. Under laboratory ons a female laid as many as 30 eggs. Eggs are 0·3 mm. long mm. broad and rounded at both ends. Generally they are seen on the delicate silken webs of the mites. Egg period is about 3 to 4 days. The newly hatched grubs are over 1 mm. in length and pale white in colour. The head and thorax are large and the abdomen short with terminal claspers. Legs are comparatively large and stout. The body segments have rings of transparent hairs. Grubs when mature measure 2 mm. in length and 0·75 mm. in breadth and are pale yellow in colour, with stout dark hairs. The larval period is from 4 to 5 days, the number of moults being three. The grubs feed mostly on eggs piercing the egg shell and sucking the contents, but occasionally they may go in for other stages also.

The pupae are dark black in colour. The larval hairs persist on the pupae. At the hind end there is a cap-like portion which is pushed out when the adult emerges. Pupae are generally attached to the lower surface of the cholam leaves. The pupal period lasts 3 to 4 days. The adults which emerge are dark black in colour and measure 1·3 mm. long and 0·8 mm. broad. The males are slightly smaller than the females. Adult beetles also feed on mite eggs. Occasionally they may feed on mites also. If kept without food the adult beetles live only from 4 to 6 days. When given sufficient food they live for about three weeks. In one case an adult lived for 35 days.

2. *Scolothrips sexmaculatus*, Pergande.* This insect (Fig. 4) belongs to family Thripidae, (sub-order Terebrantia, order Thysanoptera). It is commonly known as the six-spotted thrips. The nymphs and adult thrips feed chiefly on the eggs but occasionally stages of mites other than eggs are also attacked. It has been found that the time taken to finish one egg is about a minute. The adult thrips can easily be spotted out, the three dark spots on each forewing being very characteristic of this species.

3. *Oligota flaviceps*, Bernh. (Fig. 5). This beetle belongs to family Staphylinidae. In this case the adults are harmless but the grubs are very active creatures destroying mite eggs. They are yellow in colour. A dark spot at the hind end of the abdomen is quite characteristic of the grub. When full fed the grubs pupate in the soil.

4. *Triphleps tantilus*, (Fam. Anthocoridae). Some of these
were found attacking the mite nymphs. These are not so
checks as the first three. The whole life cycle of the bug
two weeks.

5. *Geocoris sp.* This bug belongs to sub-family
family Lygaeidae. On certain occasions these
the adult mites and nymphs. The life cycle
weeks, the egg period being 4 to 5 days.

6. *Gamasid mite.* It is yellowish in
about actively in search of mites. It att
puncturing their body and sucking in th

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* This thrips identified by Dr. T. V. Ran
Trans. of St. Louis Acad. 1894, page 54

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An indigenous blade-harrow.

Insecticides tried at Coimbatore. The following insecticides were tried and results of these trials are given below in tabulated form.

	Name of insecticide.	Treatment & Strength.	Results.
1.	Flowers of sulphur.	Dusted 1 lb. to 4 lb. road dust.	Good against mites. Leaves not scorched.
2.	Fish oil Rosin soap.	Sprayed. 1 lb. in 6 gal. of water.	do.
3.	Crude oil emulsion.	do.	do.
4	Soap solution.	Sprayed 1 lb. in 4 gal. of water.	Not satisfactory.
5.	Harbas.	Sprayed 1 in 40 parts of water.	Fair but leaves scorched.
6.	Harola.	do.	do.
7.	Vermisapon.	Sprayed 1 lb. in 10 gal.	Fair.
8.	Tobacco decoction.	Sprayed 1 in 4 gal.	Not satisfactory.
9.	Germicide.	Sprayed 1 lb. in 10 gal.	Fair.

Methods of control. 1. Be on the look-out for the first signs of attack. It is easy to spot them out due to the presence of red patches on the leaves. Pull out the first attacked plants and destroy them or dust flowers of sulphur on the plants by means of hand bellows. In the later stages, when the attack has already spread and injury done, it will not be of any use to have recourse to dusting.

2. Keep the bunds clean of grasses like *Panicum Javanicum* as the mites can live on them.

Acknowledgments. In conclusion, the writer wishes to thank Rao Sahib Y Ramachandra Rao for his valuable advice in the course of this work and Mr. Hirst for kindly identifying the specimens.

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l History Series.
Effect GREGOR, E.A. "Red spider control" *Jl. of Eco. Entomology*, Vol. VII,
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rains seem to LE H. J. "Some natural enemies of spiders and mites" *Jl. of Eco.*
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N THE COURTALLAM HILLS

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devise he female beetle after mating * of *Agriculture, Tinnevelly.*
a cholans a female laid as many as the Courtallam hills in the Thekku-
* Mr. mm. broad and rounded at Udatram and at Five Falls hills.

Tetranvchus
and Tea bug of

There are on the whole in the Courtallam hills 76 Mangosteen trees i. e. 50 trees at Thekkumalai, 14 trees at Arivikkarai, 7 at Udatram and 5 at Five Falls hills. It thrives very well in elevations which are from 1,500 to 3,000 feet above sea level. It requires a cool atmosphere. Every year out of these 76 trees about 20,000 fruits are brought down and sold at Courtallam during the season from June to September.

Cultivation. Fruits which are quite ripe are picked up from well-grown trees. Immediately the seed is removed from each fruit and the seed is sown in mud pots of one foot diameter and one foot height the pots being filled with well-rotten cattle manure and fine silt. The contents in the pots are kept moist always. The pot with the seed sown in it is kept at the foot of the hills or in the hill itself where it is cool. After two years, the seedling which would have been 9 inches high by this time is removed and planted in pits of 3 feet cube and spaced 25 feet apart. The planting is generally done just at the commencement of the south west monsoon. In elevated places ranging from a height of 2,000 to 3,000 feet the pit prior to the planting of the seedling is simply filled with fine earth. No manure is applied. As soon as the seedling is planted, fencing is done all round to act as wind break and to protect the young seedling from the sun. When there is no rain, the seedling is watered once in 3 days. Brackish water is harmful to the seedling. Only good water should be used. After 30 years from the time of planting the tree begins to yield. A good tree will yield even 2,000 fruits per year but the average yield per tree is only 250 fruits. At 12 annas per dozen, the average money value of fruits per tree is Rs. 16. About 50 trees can be planted to the acre and the money value per acre from fruits collected is nearly Rs. 800.

25 yards long
On the Courtallam hills, Mangosteen is not culti foot of walking
is cultivated along with tea, coffee, cloves, etc. Th the area of one
profit of nearly one rupee per 100 fruit. gentle slope is also
rspace between beds

CULTIVATION OF CHILLIES* IN G

sprinkling water. If

BY P. GOPALARATNAM, mination is followed by

Cotton Assistant, Agricultural Resear

Introductory. Chillies, though classice, raised seed beds are
condiments and spices, form one of theion, Guntur. These facili-
Madras Presidency as it is a daily ng stages of the nurseries
and poor alike. The crop with its wie in patches due to excess of
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south and as a rain-fed crop in the nd between fingers and covered

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* *Capsicum fruitescens.* *1. Pennisetum t*An indigenous blade-harrow.

is one of the important chilli centres in the Circars. The present article is mainly confined to the cultivation of the chilli-crop in the Guntur District.

Soil. The crop is cultivated in black soils. They are heavy with good retentive capacity for moisture. The texture of the soil is fine with an admixture of clay, and sand with lime in small pebbles. The high retentive capacity of the soils, the fairly good rainfall after the transplanting of the chilli-crop, and the industrious nature of the ryot who conserves the soil moisture at every stage, go to the successful cultivation of the crop under rain-fed conditions.

Rotation. The time-honoured rotation of the place is to raise a grain crop of *jonna*, (sorghum) *sajja*[1] or *variga*[2] in the first year which will be followed by chillies and tobacco respectively in the succeeding two years. Chillies following *variga* is considered to be the best as it is the least exhaustive crop of the three mentioned above. The popular belief is that the chilli crop raised year after year in the same field produces gold, meaning thereby that bumper yields can be expected. In order to find out the validity of the statement a plot has been set apart last year by the farm staff of the Agricultural Research Station, Guntur to grow the crop as mentioned above. After the introduction of the groundnut, the ryots are more after that crop as it gives them money at the kist time and hence are sowing that only on a large area unmindful of the principle of rotation.

Preparatory cultivation. With the advent of the South-West Monsoon in June, the ploughing commences. This consists in ploughing the land with a heavy country plough both ways. In so doing the plough furrows are cut at regular distances so that small ridges and furrows are formed for allowing the soil to absorb as much of the rain

Rao Sahib i -ible. Indirectly the furrows also help drainage and pro-
of this work and M soil from being washed away in times of heavy rain.
the place is to work all the cultivators at least once
f 1. NATHAN BANKS inciple is a sound one, in that, it ploughs all the
U. S. A., Department of Ag. left by country plough. By about the middle
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ma 1. *Scymnus gracilis*, Motsch. oden tynes are fixed two feet apart, is
susp portant enemy of the cholam N T ansplanted at the points of inter-section.
with eggs and occasionally also on OCKing an exhaustive one, is manured direct
devise he female beetle after mating I *of* receives 15 to 20 cart-loads of cattle
a cholams a female laid as many as 3 t 000 to 2,000 sheep are penned costing

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* Mr. mm. broad and rounded at ba *um miliaceum.*

Tetranychu. —
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Rs. 15 to 20 per acre. Sheep-penning is considered to be the best for the reason that the manure gets incorporated in the soil readily without leaving any decaying vegetable debris for the cock-chafers to lay eggs and the grubs to feed on. Chillies obtained from a sheep-penned plot are believed to get a bright colour. In the tract, the attack of cock-chafer grub is a menace and any remedy suggested to overcome it is a boon to the cultivator. When once the eggs are laid, grubs emerge and attack the transplanted chilli seedlings in the absence of decaying vegetable matter. As a preventive, facilities for laying eggs should not be created.

Nurseries. The foundation of the chilli crop is in the seed-beds and hence they are to be prepared with the utmost care for the production of healthy seedlings. A good stimulus given at the start will overcome all the intervening temporary set back and finally give a good crop. The nurseries are usually raised on a high piece of land near small ponds of water which are locally known as *kuntas*. The *kuntas* are dug generally just by the road-side so as to get the advantage of drainage water. No regular crop is raised over the seed beds but they are used as nurseries of chilli and tobacco year after year.

The portion is ploughed well three or four times and worked with a *gorru** once or twice, to produce tilth. The whole thing is finally levelled up with a *guntaka*‡. Like the main-field, nursery portions also are heavily manured with cattle manure and composted tobacco suckers. The local experience is, that tobacco compost forms an excellent manure for chilli nursery. By about the end of June or beginning of July, chilli seed at a rate of 1½ to 2 *manikas* or 4½ to 6 lbs. is broad-casted over a cent in long narrow beds and covered by working the *gorru* lengthwise and cross-wise. The beds are 20 to 25 yards long and 1 to 1½ yards broad. They are separated by one foot of walking space along the length of the beds. Seedlings from the area of one cent will be sufficient to transplant an acre. A gentle slope is also provided for giving a natural drainage. The interspace between beds come off handy for the purpose of weeding and sprinkling water. If the germination were to be poor or a good germination is followed by drought, hand watering is resorted to.

As an improvement over the local practice, raised seed beds are prepared on the Agricultural Research Station, Guntur. These facilitate good drainage especially in very young stages of the nurseries when the tender seedlings are prone to die in patches due to excess of moisture. The beds are 40 yards by 1½ yards with a gentle slope running from one end of the bed to the other. Well-rotten cattle manure made into fine powder is applied to the beds. Chilli seed at the rate of three to four lbs. per bed is sifted between fingers and covered by working the *Kanki-danti* * along the length and breadth of the bed. One or two coolies walk over the bed pressing the loose surface with their feet so as to give a firm footing to the tender seedlings. After consolidating the beds, they are watered either with a rosecan or by sprinkling water. Watering the bed is continued daily once or twice till the germination is completed lest the surface should be too cracked exposing the radicles to the hot sun. The seedlings under this system come up vigorously and are healthier than those obtained by the local method.

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* An indigenous tyneharrow. ‡ An indigenous blade-harrow.

The seeds commence to germinate on the third day after sowing by sending their radicles into the soil. On the fourth day the bends of hypocotyls are sparsely visible. A greater number of these can be seen on the fifth day. In a very few cases the plumules emerge out on the sixth day but in general the seedlings with their first pair of linear lanceolate cotyledon leaves can be seen on the seventh and eighth days. The nurseries are weeded from time to time and at times the struggling seedlings, are helped by lifting the surface crust.

In about six to seven weeks the seedlings get ready for transplanting. Usually a week or 10 days before the time of transplanting the seedlings are topped on a bright day early in the morning. The idea of topping in the morning is that the healing of the cut ends must take place as quickly as possible during the hot part of the day. The stem of the chilli plant is hollow and if even a light drizzle were to follow the topping, the stem gets rotted and becomes watery. Topping facilitates profuse side branching and the thickening of the main stem. Well-developed chilli seedlings come off easily for distribution at the time of transplanting and remain erect even when the plants are in their full bearing. The nurseries are watered the evening previous to the day on which the seedlings are removed. This saves the tender roots from being severed. The seedlings are tied into bundles and the roots are washed free of soil and kept covered in baskets till the time of planting. Chilli seedlings are transported to long distances in head-loads or by carts. Generally the seedlings are removed in the morning and transplanted in the evening.

Transplanting. This is done in the evening so as to give the seedlings the advantage of cool temperature during the night. The season for planting extends over a month and is generally done in September. In a few cases it may be done as late as the middle of October. In villages which are in the vicinity of towns, commanding good marketting facilities a few ryots transplant the seedlings very early in June. These plots are primarily intended for raising green chillies for the vegetable market.

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* A small wooden rake for gathering ear-heads on threshing floor.

In the Guntur District two methods of transplanting are in vogue viz. (a) Transplanting the seedlings with the help of hand watering and (b) *Burada-natu* or planting the seedlings in a miry condition of the soil.

(a) At the time of transplanting, one man goes in advance and makes a small hole with a bamboo stake or a wooden peg at the places of intersections mentioned above. Another man following the first pours water in the holes when two or three women coolies distribute seedlings to the transplanting women. The seedlings are placed in position in the watered holes and are pressed firmly. The number of seedlings per hole varies with the quality of the seedlings. Seedlings raised under local conditions require six to eight per hole while those raised after the Agricultural Research Station fashion need only four seedlings.

(b) *Burada natu* as the name indicates is done immediately after a heavy down-pour and when the soil is very wet. This dispenses with the extra cost of hand-watering at the time of transplanting. Unless a rain is received soon after planting, the seedlings suffer badly as the soil gets hardened by this method. It is always better to wait, water and then transplant the seedlings when the soil is in a fit condition to receive them.

Transplanting and filling in gaps created by the attack of cockchafer grubs should be done as early as possible for giving the plant sufficient time for vegetative development before they come to flower. In about six to eight days the transplanted seedlings strike new roots and get established.

After cultivation. If the weather conditions are favourable the *Dontulu* is worked once or twice both ways. The operation removes weeds and forms surface mulch. The finishing of the above operations synchronises with the general commencement of flowering which will be roughly about a month from the time of planting. At about that time the field is ploughed with a country plough between rows along the length and breadth of the field By this a sort of root pruning is given to the plants. The plants once again put forth fresh roots and grow vigorously.

Flowering and Setting. Flowering in chillies commences from October. Usually the setting of the first formed flowers is rather poor for the nights will be dewy and the Guntur District experiences heavy rain in October and November. The two phases viz. dew and heavy rain cause a lot of the flower buds and set fruits to shed in the early stages of the crop. By about the end of December or beginning of January cool sea-breeze which is popularly known as *Pairu-gali* (crop-wind) commences to blow during night time. This has a miraculous effect on all dry crops by giving them new vigour and acts as a tonic on the standing crops. It is during this period that one more flush takes place with the maximum setting.

Harvest. The crop comes to harvest in about 3 to 3½ months from the time of planting. The early formed fruits come to harvest in December. Two more pickings are taken say one in January and the other in February. Since the harvest time comes in summer no difficulty is felt for drying the chillies.

Yield. In good years the crop yields 1 to 1½ candies‡ of dried chillies per acre costing Rs 100 to 150 per candy according to the market fluctuations.

Varieties. The varieties of the locality are 'Bellary', 'Local' and 'Nallapadu'. The fruits of the Bellary variety are broad and long. Locals are light green, medium, broad and short while the Nallapadu chillies are narrow and long with dark green colour. In the local market the Nallapadu chillies fetch Rs. 1 or 2 more per candy than the other two types for the reason that the pedicel along with the calyx adheres firmly to the fruit even after drying. The calyx is loose in the other two varieties and gets separated from the fruit either at the time of picking or drying whereby the seeds which contribute most to the pungency are lost while drying and storing.

Marketing. The dried chillies are pressed in gunnies epecially stitched for the purpose and known as *Boras*. Each *bora* holds half a candy (250 lbs) of dried chillies. These are transported to Guntur and are sold to wholesale dealers.

Export. The major part of the production in the presidency is consumed within India and the balance working roughly to 35 per cent. of the total exports from India, is exported to Ceylon, Strait Settlements, Mauritius, Aden and the United Kingdom.

Uses.* Chillies are put to several uses. They serve as a bite in the green state for the working classes at the time of taking their morning *kanji* †. The green fruits are pickled or cooked fresh with various kinds of Indian dishes. The fruits are used in all its stages of their development viz. tender, green, ripe and dried as well. The dried fruit reduced to powder forms the 'Cayenne' of commerce. Cayenne as a rule is prepared from pungent types of fruits. For all culinary purposes red chillies are preferred as they impart their red colour to the preparations.

In Bengal an extract of the consistence of treacle is regularly prepared and sold. There are various brands of pepper sauce which are produced as decoctions of the fruit in salt or vinegar. 'Tobasco' and 'Paprika' are the special European sauces.

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‡ One candy=500 lbs.

* This para has been largely drawn from the Commercial products of India by Sir George Watt.

† Rice gruel.

As a medicine, capsicum is stomachic, stimulant and astringent and an ingredient in most medicines that are intended to alleviate toothache. As a rubifacient and counter-irritant the bruised fruits, in the form of a poultice, act energetically, and added to mustard are often highly beneficial.

Deterioration. Of late the chilli crop in the district is in a state of decline due to the insecurity of reaping the fruits of the toil and the low prevailing market value for chillies. The low price offered is not only due to the trade fluctuations but also due to the inferior quality of the chillies that are being cultivated. The deterioration in the quality can be attributed to,

1. Introduction of the ground-nut crop.

2. Negligence on the part of the ryots to select and reserve their own seed for next year's sowing.

. 3. Admixture of superior and inferior types at the time of drying.

(1) It is nearly 10 years since ground-nut crop found its way into the tract. Since then the area under chillies is dwindling and the yields are also becoming low while the area under ground-nut is proportionately increasing. Thrips found on ground-nut leaves have developed a taste for the chilli crop. To their advantage the harvesting time of ground-nut and the transplanting time of chillies coincide. The thrips leave the drying crop of the ground-nut and pass on to the fresh crop of chillies. The damage done by the insect is considerable for their size and in cases of bad attack the whole crop fails to the utter dismay of the cultivator. People have come to realise that this is due to the introduction of ground-nut. Every one waits for the other man to stop cultivating the ground-nut but no one has taken the lead so far.

(2) One bad practice with most of the cultivators of this place is to sell their produce completely without keeping any seed for next year's sowing. Especially in chillies the ryots dispose off the good stuff at the high prevailing market rate and for seed purchase the sweepings of the common drying floors at a very low price from depressed classes. Thus the quality gets deteriorated by the wanton negligence of the ryots.

3. At the time of chilli harvest one common drying floor is prepared in every village for purposes of safety. Unless one is very careful there is ample scope for the different types to get mixed while spreading daily for drying.

For some reason or other work on this useful crop was not taken up in this presidency till 1931. Considering the deterioration of the crop and the varied uses of chillies it was felt that work on this essential crop should be taken up for evolving types of chillies which are superior in yield and quality than those commonly cultivated. With the kind permission of the Cotton Specialist and the Deputy Director of Agriculture, Second circle, the writer has started selection work at the Agricultural Research Station, Guntur, last year.

Pests and Diseases. The major pests of the place are thrips and cock-chafer grubs.

Thrips. (*Scirtothrip dorsalis* Hood). The minute insects attack the crop both in the nursery and in the advanced stages. The damage becomes all the more severe when the plants begin to flower and bear. The eggs are laid in leaf-tissues. The nymphs that emerge out of the eggs cause a drain on the leaves and make them curl. The curling of the leaves is known as *Mudatha.* In cases of severe attack the curls increase greatly and the normal development of the plant is arrested. The plants become stunted, leaves get reddened and finally they succumb to the attack. The pest is virulent during dry weather and gets reduced in the rainy season. The attack in the severe form is called *Korivi.*

Cock-chafer grubs. (Melolonthrid beetle) These make their appearance in the main field where the seedlings are transplanted. They burrow into the soil and cut the growing plants just above the root system. As a result of the attack the plants dry up and drop to the ground. When once the grubs cut away the plants at a place they move on to the next and so on. The grubs can easily be spotted through the dying plants. They can be removed and destroyed by digging the soil at the place of attack. They are chiefly found in singles and rarely in doubles.

Fruitrot. (*Vermicularia Capsici* Syd.) This is a fungoid disease and appears only to a small extent both in the green and ripe chillies. Fruits turn yellow, and rot and sunken spots with black dots arranged in concentric circles are found. The fruits lose their pungency and become useless.

APPENDIX

Cost of cultivation of the chilli crop under the local system. (Per acre)

		Rs.	A.	P.
Preparatory cultivation.				
Preliminary ploughings	two (2 pairs & 2 men)	2	8	0
Diagonal ploughing	one (1½ pairs & 1½ men)	1	14	0
Final ploughings	two (4 pairs and 4 men)	5	0	0
Marking with country plough and chilli marker	(1 pair & 1 man)	1	4	0
Manures and manuring.				
Cattle manure	15 cartloads at Re. 1 Per cart-load	15	0	0
Sheep penning	(1500) at Re. 1 per 100	15	0	0
Spreading and covering with country plough (1 pair & 4 men)		2	3	0
Seed-bed. (1 cent).				
Ploughing, working *gorru*, covering manure levelling etc.	(1½ pairs and 1½ men)	1	14	0

Half a cart load of cattle manure	...	0	8	0
Cost of 6 lbs. of chilli seed.	...	1	4	0
Hand watering three times. (1 man)	...	0	8	0
Transplanting.				
Pulling seedlings, washing carrying, watering and transplanting complete. Contract rate at Rs. 3 per acre.	...	3	0	0
After Cultivation.				
Working country plough (1 pair and 1 man)	...	1	4	0
Harvesting.				
Collection of chillies 3 times (40 women)	...	7	8	0
Drying and Marketing.				
Charges for 1½ candies	...	1	5	0
Total.	...	60	0	0

CULTIVATION & EXTRACTION OF SUNNHEMP FIBRE

SOME ECONOMIC ASPECTS

By R. CHOCKALINGAM PILLAY, L. Ag.,

Assistant Director of Agriculture, Tinnevelly.

This crop is largely cultivated for fibre in Nainaragaram, Tenkasi Taluk and also in Aikudi village, 6 miles from Tenkasi (Travancore area). The area under this crop for fibre in Nainaragaram is about 25 acres. This crop is also grown in Elangi in about 10 acres for fibre.

Season. Sunnhemp for fibre extraction is sown in wet lands between the last week of May and the first week of June.

Nature of soil. It requires rich loamy soil with good drainage facility

Seed-rate. The seed-rate per acre is 56 Madras measures and it costs Rs. 12–8–0.

Preparation of the land. The land intended for sowing sunnhemp is ploughed four times. No manuring is done. After sowing the crop is irrigated once in 10 days. The water stored in tanks is used for irrigation. The crop is not irrigated here from wells. On the whole till the time of harvest, about 9 irrigations are given and it costs Rs. 3—6—0 per acre at 6 annas for each irrigation.

Sowing expenses. For forming beds and sowing one acre three men are required and it costs Rs. 1—8—0.

After cultivation. For watching the crop, Rs. 3 is spent.

Harvesting. The crop is harvested for fibre after 100 to 105 days from date of sowing For harvesting an acre 12 men are required and it costs Rs. 4—8—0 at 6 annas per man. After harvest, the crop is tied into bundles and it is stacked for which 4 coolies are required and it costs Rs. 1—8—0. Then whenever fibre is required, the bundles are removed from the stack and steeped in water for 5 days. On the 6th day they are washed well, dried in the sun for two or three hours, then with hand they remove the fibre from the stem. The fibre is again dried, made into twists and is kept ready for sale. From steeping till the extraction of fibre, the cooly is paid at 8 annas per *thulam* (14 lbs.) of fibre so extracted and for an acre the yield of fibre is about 50 *thulams* and each *thulam* costs Rs. 2.

Cost of cultivation of Sunnhemp per acre and the money value of fibre per acre.

Preparatory cultivation.	Rs.	A.	P.
Ploughing	4	0	0
Cost of seed per acre	12	8	0
Sowing expenses	1	8	0
Cost of irrigation	3	6	0
After cultivation	3	0	0
Harvesting	4	8	0
Bundling and stacking	1	8	0
Steeping and extracting fibre at 8 annas per *thulam* for 50 *thulams*	25	0	0
	55	6	0
Yield of fibre per acre—50 *thulams* at Rs. 2 per *thulam*.	100	0	0
Profit per acre.	44	10	0

THE PRESENT POSITION OF THE LAC INDUSTRY IN INDIA

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The lac industry in India has been drawing much attention in recent years, firstly on account of the "boom" which the industry enjoyed in the post-war period, when fabulously high prices prevailed and a great demand for lac existed which exporters were unable to meet, and secondly, on account of the crisis through which the industry has been passing during the last few years, owing to trade depression and low prices. Probably, no other industry in India is in such a disorganised state, in respect of cultivation and production as well as of marketing and industrial utilisation; and this, in spite of the fact that India holds the world monopoly in this important raw material. The object of the present article is to point out the importance of encouraging the utilisation of lac within the country itself, in the manufacture of various lac products, for which more technical skill than large capital is necessary, so that a demand for lac within the country may be created and, coupled with an organisation among exporting agencies for the proper regulation and control of the lac export market, the Indian lac industry may be placed on a stable basis, without having to depend for its outlet wholly on the export-trade, which has resulted in the past in speculation, unhealthy manipulation and violent fluctuations.

Cultivation of Lac. For the information of those not familar with the methods of lac production, it may be stated that lac is a resinous secretion formed by a species of scale insect known as *Tachardia lacca* (of which there seem to be many strains in India, e. g. indica, nagoliensis, sindica, chinensis, mysorensis, communis, cf. Beeson, 1924), which live parasitically on the young branches and twigs of host plants like *Palas* (*Butea frondosa*, Roxb.), *Kusum* (*Schleichera trijuga*, Willd.), *Pipal* (*Ficus religiosa*, L.) *Babul* (*Acacia arabica*. Willd.), *Arhar* (*Cajanus indicus*, Spreng.), *Shorea talura*, *Acacia frasenius* etc., inserting their probosces into the bark of the host plant and absorbing their nutriment from the host, during the completion of their life-cycle, which may take from 17 to 25 weeks (there being thus two or in some cases three lac seasons in the year). The insects continually exude the resinous secretion over their entire bodies, and cover themselves with a cocoon-like shell of lac, which later cohere to form a hard mass over the twigs and branches. The amount of lac secreted by a female is about 100 times that of a male, and the exudation is most active for a period of 8—10 weeks after impregnation by the male, which takes place about 10 weeks after the larval stage. At the end of its cycle, the female dies and from its ovary emerge a swarm of larvae, often amounting to about 1000 per mother insect. For more details regarding the physiology and habits of the lac insect and methods of cultivation, the reader may refer to the memoirs of Stebbing (1908), Imms and Chatterjee (1915), Misra (1923) and Glover (1931).

Even though the lac insect is widely distributed in India, it flourishes best only in certain areas, and it is in these areas that lac is produced in abundance. The lac-belt of India is concentrated in an area comprising Chota Nagpur, Orissa, Berar, the north-eastern half of the Central Provinces, the northern districts of Bengal and parts of the United Provinces, though it tails away in the west to Sind, in the north to the Punjab and in the east to Assam and Burma, the quality of lac produced in the last two areas being comparatively poorer. Small quantities of lac are produced in Mysore and the Hosur Plateau, (Salem District). Outside India, lac is produced in Indo-china, Siam and the Straits Settlements, but the quantities marketed are very small, amounting to about 5% of India's produce. The ecological relationships of the lac insect have not been so far systematically studied. Even in the areas where the lac insect flourishes, the amount of lac secreted by the insects at any given place and in any given season, is a very variable quantity, which is conditioned by a number of factors including (1) the suitability of the host plant, (2) the vitality of the host plant as determined by conditions of soil, weather, manuring, stage of growth etc., (3) vitality and hardiness of the strain of lac insect; (4) weather conditions, excessive heat or humidity being unfavourable for lac production; (5) absence of the natural enemies of the lac-insect or lac hosts, like fungi, bacteria, parasitic insects, parasitic animals etc., (6) physiological factors like sex-ratio among the insects.

The secretion of the lac insect consists of a mixture of lac-resin, lac-wax, lac-dye and honey-dew. Puran Singh (1911) quotes analyses of crude lac as containing about 65 to 80% of lac resin, about 6 to 10% of the red colouring matter (lac-dye), 4 to 6% of lac-wax, 2 to 5% of vegetable gluten, mixed with accidental impurities such as water (up to 4%) and small quantities of wooden fibre, puparial remains, sand etc.

One interesting feature of the lac industry in India is its highly scattered nature. Even though in favourable years, as much as 743,000 cwts. (or about a million maunds) of lac were exported per annum, several hundreds and thousands of persons (mostly poor peasants and hill-tribes) were responsible for the collection, the individual quota of each producer hardly averaging more than a few seers. Naturally, middle-men play an important role, for good and bad, in the collection and marketing of the produce—a fact which has to be borne in mind in considering the economics of the trade and in devising ways and means for improving the present position.

The lac export trade of India is an old one, but in the early days (1800—1820), large quantities of lac-dye were exported and the preparation of lac-resin (shellac) was considered to be of subsidiary importance. After the advent of coal-tar dyes, however, the demand for lac-dye grew less, so that this commodity went practically off the market after 1890; but, fortunately for India, the demand for shellac showed, after the above date, a rapid and remarkable increase, which reached its height during the post-war period. Now, most of the lac exported from India is in the forms of shellac, only small quantities of inferior forms like grain-lac, garnet-lac, button-lac and stick-lac being sent out; other products like lac-wax and lac-dye do not figure in the export trade.

Manufacture of Shellac. The following gives an outline of the indigenous method of preparation of lac for the export market. The twigs containing the lac secretion (stick-lac) are crushed either by hand or by machinery, sieved and winnowed, to separate the granules from the twigs; the residual dust contains some lac with most of the wax and insect bodies. The granules of lac are washed either by machinery or more usually by treading them under feet with water in tanks, in order to remove the lac-dye, which dissolves out into the water; the highly coloured liquid is decanted off and the dye precipitated by the addition of lime or alum and sold in the form of cakes as crude 'lac-dye'. The washed granules of lac known as "grain-lac" or "seed-lac", are next worked into shellac by transferring them into long hollow cylinders of strong calico, where they are mixed with a little orpiment (arsenious sulphide) and some low-melting resin like Colophony, and carefully heated over a fire, keeping the bag rotated. The lac oozes out through the calico and is scraped with a spatula, mixed with some water and basted into a homogeneous molten mass. The molten lac is spread on the surface of large stone-ware vessels containing hot water, till it is about a foot square and 1/8 inch thick; at this stage, a skilled workman takes it up, waves it in front of the fire to partially soften it, and at the proper moment, seizes it with his fingers, toes and teeth and stretches it into a thin sheet some 3 ft. square, of almost equal thickness through-out. These sheets broken up, constitute the shellac of commerce.

The colour of shellac varies from dark orange to pale yellow, the latter being preferred. Pure shellac is insoluble in water, but wholly soluble in methylated spirits or ethyl alcohol, besides other organic solvents. The trade requirements of good shellac are chiefly cleanness, as judged by freedom from dirt and insoluble matter or adulterants like rosin, and secondly pale-ness of colour. Shellac is usually sold under the mark "T. N.", though the origin of this mark is not definitely known. "T. N." mark may contain up to 3% of insoluble impurities.

Lac trade of India. Most of the lac exported from India is in the form of "shellac", a comparatively smaller quantity of "seed-lac" and negligible proportions of "button-lac" and "stick-lac", being sent out. The relative quantites of these forms which are exported and the important countries which show a preference to particular forms, is shown in Table I.

Table I. Showing exports of different forms of lac. (Exports given in thousands of cwts.)

Years.	1925-26	1926-27	1927-28	1928-29	1929-30	1930-31	8 months April -Nov. 1932	Av. price in 1932 per cwt. Rs.
Total lac Export ...	539·9	592 0	543·6	743·4	668·9	547·2	284·0	...
Shell lac ...	416·6	424 9	404·4	530·7	498 3	366 4	167·4	33
„ to U. S. A.	226·9	239·5	170·1	237·0	225 7	117·0	46·6	
„ to U. K.	82·7	86·9	117·6	135·3	120·3	95·8	51·1	
Seed lac ...	37.4	89 4	54·7	92·4	68·0	106·3	90·9	26.
„ to U. S. A.	32·8	84·0	49·2	82·8	57·0	82·0	66·5	
Button lac ...	21·7	20·6	18·0	24·7	24·2	23·7	11·6	40.
„ to U. K. ...	11·0	11·6	11·6	14·7	14·8	15·8	8·2	
Stick lac ...	22·8	7·2	9·1	26·5	6·4	4·7	3·7	19.

(U. K. = United Kingdom; U. S. A. = United States of America).

The figures show that previous to 1928, about 75% of the exports was in the form of shellac, about 10% in the form of seed-lac and about 10% in the form of button-lac, most of the seed-lac being taken by the U. S. A. and the button-lac by the United Kingdom; but in recent years, however, U. S. A. have shown an increased demand for stick-lac (probably due to its cheapness and its comparatively "raw condition" amenable for any desired treatments), at the cost of their imports of shell-lac, so that now, computed on total exports, shell-lac has fallen to about 60%, seed-lac has risen to 30% and button-lac has fallen to 5%.

Table II gives an idea of the volume of the total lac export trade of India, since 1880 onward, both in regard to quantity and value. The figures include exports of all forms of lac, like shell-lac, seed-lac, button-lac and stick-lac and the remarks noted under Table I regarding the recent preference of U. S. A. to seed-lac, and the relative volume of trade in the different forms of lac, may be borne in mind while examining the figures given in the table.

Table II. Total Lac Export Trade of India.

Official year April to March.	Lac Exports in thousands of cwts.			Total value of Exports in lakhs of Rupees.	Average price per cwt. in Rs.
	Total Exports.	To Uuited Kingdom.	To U. S. A.		
1880—81	82·1			56·5	69
1890—91	147·2			87·1	59
1900—01	219·9	73 2	70·9	103·9	47
1902—03	231·6	108·4	82·1	180·8	78
1905—06	263·4	78·5	119 1	310·2	118
1908—09	372·2	93·2	146·8	273·6	74
1910—11	421·6	105·5	161·1	214 3	51
1912—13	428·2	82·2	171·7	211 3	50
1914—15	366·7	89 4	179·7	160·6	43
1916—17	381·4	48·9	240·3	280·3	74
1917—18	322·4	59·5	204·9	377·8	118
1918—19	239 1	67·4	100 2	294·8	124
1919—20	375·7	104·3	228·8	726·4	194
1920—21	308 9	55·1	208·2	758·3	246
1921—22	434·9	86·1	245·2	791·6	182
1922—23	476·0	88·4	246·2	1026·5	216
1923—24	485·7	88.3	245·5	906·3	187
1924—25	428·2	78·9	175·1	755·1	176
1925—26	539 9	96·7	264·9	690·1	128
1926—27	592·0	101·5	327·2	547·2	93
1927—28	543·6	133·3	221·2	693·9	128
1928—29	743·4	156·9	323 3	864·3	116
1929—30	668·9	142·9	286·2	696·7	104
1930—31	547·2	121·4	200·9	313·7	57
1931—32	455·6	105·3	177·5	179·0	39
8 months April—Nov. 1932.	284·0	67·2	113 5	84·2	29

(The figures for 1900 onward are taken from the "Accounts of the Seaborne trade of India", published by the Govt. of India; those for 1880 and 1890 are taken from Stebbing (1908). On account of the wild fluctuations in price, often from month to month, average prices ta have been worked out in the last column by dividing total value of exports by total weight of exports per year, as giving a better indication of the variation of prices from year to year).

The following points may be noted from the figures given in the Table:— (1) The lac trade of India showed a healthy and progressive development up to 1914, when prices were maintained constant in spite of production being quadrupled. (2) During the War period, there was a temporary fall in production due to absence of exports to Germany and other belligerent countries, and the control of the trade by the Munitions Board. (3) In the post-war period of 1919—1924, there was a great increase in demand and rush for lac, on account of increased industrial applications, but production though steadily increasing could not meet the demand, with the result that there was a good deal of speculation, attempts at 'cornering' and artificial manipulation of the market, and a soaring of prices to fabulous levels, e. g., Rs. 246 per cwt. in 1920—21, as compared with the present price of Rs. 29 per cwt. in 1932. It was during this period that attempts were made by the Government of India, as will be described later, to improve the cultivation and production of lac, but such increase could only be slow, considering the peculiar circumstances conditioning the production of lac. It was also during this period of high prices that various shellac substitutes were placed on the market by German and American chemists most of them being condensation products of aldehydes with phenols or amines. (4). To a certain extent, these synthetic products established a foot-hold in the market, and their effect is seen in the succeeding period from 1924 to 1929, when lac production increased, but there was no corresponding increase in demand, with the result that prices began gradually to climb down from Rs. 187 per cwt. in 1924 to Rs. 104 in 1929. (5) After 1929, there has been a rapid fall both in demand and prices, the fall synchronising with the general trade depression affecting all commodities. The export has decreased from 743,400 cwts. in 1928—29 to about 455,000 cwts. during 1931—32, and the figures for the current year promise to be still worse; and the price has fallen from Rs. 104 per cwt. in 1929 to below Rs. 30 per cwt. in 1932, a ridiculously low level which it never reached before, even in the earliest days. (6) Another fact that may be noticed is that our best customers are the United Kingdom and the United States of America. In former years, the U. S. A. took twice or more as much lac as the United Kingdom, but during the last few years, her demands have fallen off (probably due to her greater use of synthetic lac substitutes), while the United Kingdom has maintained hers. Germany, France and Belgium are now taking increasing quantities of Indian Lac.

Causes for the present depression. Considering the great importance of lac for the manufacture of several products, whose use is increasing day by day, and the almost monopolist position which India holds in the marketing of this product, it may seem surprising that the lac trade should have suffered so badly during the present depression, while other less monopolist trades like the Coffee industry of Brazil, the sugar industry of Java and the oil industry of America, have borne the brunt much better. The causes for this anamolous difference are several and among them may be mentioned:— (1) The lack of organization among producers. Only about 5 per cent. or less of the total production is obtained from Government Reserve Forests, while the remaining portion is contributed by a large number of isolated farmers, peasants and hill tribes. The scattered nature of lac cultivation and the part played by middle-men in the trade, has been already referred to. For a cheaper and better method of collection, it has been suggested that co-operative societies may be organised for the purpose, and also that Government might directly purchase the lac from the cultivators at central depots. Ghosh (1929) describes a co-operative organisation backed up by the state, which has been working successfully in the Orissa Feudatory States. Similar attempts to eliminate the middle-men, as far as possible, and establish direct contact between the producer and manufacturer, will serve not merely to cheapen costs but also to improve the quality of lac produced. (2) Another factor which has brought about the deterioration of the lac market, is the wild fluctuations it has been subject to, both in respect of quantities supplied and prices. The crop available in any season cannot be predicted as accurately as in the case of staple products, and as such there is a tendency in western capitals like New York and London to stock immense quantities of lac amounting to 200,000 or 300,000 cwts. at a time, with attendant speculation and manipulation of prices. Lindsay and Harlow (1921) have shown the general inverse relationship that exists between total stocks in London and market prices of lac. This can only be solved by organising an Indian Lac Exchange, say at Calcutta, composed of the lac exporting agencies, who can purchase and stock all available supplies in India and guarantee to the world regular and adequate supplies according to demand. (3) Another adverse factor in Indian lac is the absence of proper grading and standardisation of exported material. Complaints have been received from American and European importers to the effect that even " T. N." quality of lac differs widely in respect of content of rosin and insoluble matter. A more uniform standardisation and a system of grading may help to stabilise prices in accordance with quality. For this, a scientific study of the composition of shellac and improved methods of cultivation, purification and manufacture so as to produce material of uniform quality are necessary. (4). The advent of lac substitutes prepared synthetically in Germany and America, has also played a part in dislodging lac from its natural place in world trade; but these substitutes entered the field in the post-war period when prices mounted high, and it is doubtful whether in these days of low prices, they can successfully compete with natural lac. Moreover, they cannot be used for all purposes of natural lac, and if cultivation and production be properly organised on an economical basis, there is no doubt that natural lac will again regain its old position. (5). The absence of manufacturing enterprises in India, which could compete with foreign demand in the utilization of lac, has been a serious drawback which has thrown the Indian trade completely at the mercy of the organised markets of the west. Most of the lac now exported is utilized in the manufacture of paints, varnishes, gramaphone records and electrical appliances, and as many of these do not need large capital, though requiring specialised scientific knowledge and high technical skill, it should be possible to develop them in India rapidly in the near future. (6). Proper attention has not been paid so far, to the utilization of the bye-products of the shellac industry, like lac-dye, (useful as dye-stuff and nitrogenous fertiliser), lac-wax (as substitute for bees-wax), lac-dust (or "molemma" arising from the 'sieving' preliminary to the washing of lac and containing fine grains of lac mixed with wax, dye and insect bodies), "Kiri" (a refuse remaining in the bag used for making shellac and button lac and containing lac-resin, lac-wax and animal remains), the wash-liquors or leachings in the crushing of lac etc. A scientific study of these products should enable their economic utilization and help to cheapen the cost of production of shellac. (7). The present trade depression and dislocation of exchange are presumably temporary factors, which however have revealed the weak and unsound basis on which the industry has been developed, and the present period should be taken advantage of to re-establish the industry on a sound basis.

Lac Research in India. The Government of India, as long ago as 1920, realised the importance of safe-guarding and developing the lac industry, and in 1921, appointed the Indian Lac Cess Research Committee, whose function was to conduct a Lac Research Institute and carry on other work with a view to develop and stabilise the lac industry. The Committee has been financed by the proceeds of a small cess on lac exported from India. They established in 1925 the lac Research Institute at Namkum, near Ranchi, under the directorship of Mrs. Dorothy Norris, and the Institute has carried out much useful work by way of a scientific study of the entomological and physiological problems associated with the cultivation and production of lac.

Research on lac in India has been carried on mainly at three centres—at the Forest Institute, Dehra Dun, at the Indian Institute of Science, Bangalore, and more intensively during the last few years at the Lac Research Institute at Namkum. Most of the work done so far, has been entomological and physiological, and has dealt with subjects like the life-history and physiology of the lac insect (Stebbing, 1908; Imms and Chatterjee, 1915; Glover 1931); the suitability of hosts in relation to yield of lac (Sreenivasaya, 1924; Thakur, 1932); influence of factors like soil, climate, manuring, cultural operations etc. on lac hosts and lac yield (Norris et al, 1929), enemies and pests of the lac insect and lac hosts (Imms and Chatterjee, 1915; Glover, 1931); influence of the sex ratio in lac colonies on lac yield (Mahdihassan, 1926) etc. A certain amount of work has lately been done on the improvement of methods of production of lac and on the properties of shellac, C. G. solution and precipitation methods for the separation of shellac, bleaching of lac, regulation of temperature and moisture in the manufacture of shellac, effect of humidity and storage on button-lac, the iodine value of shellac (Aldis, 1932), the physical properties of shellac solutions, the influence of orpiment on the properties of shellac (Rangaswami, 1932) etc. But very little work has been done in India on the industrial applications of lac, though there is doubtless a wide field in India for the manufacture and sale of such lac products.

The steady lowering of the export demand and the very low prices prevailing, which render lac-production a non-paying concern, have demoralised the lac trade and have told heavily on the progress in lac cultivation. Mrs. Norris (1931), who recently made a tour of the lac area in Burma, has reported that in several areas lac cultivation has been given up on account of the present depression in trade. She remarks: "It was quite obvious that owing to the low price obtainable for lac, no interest whatsoever was being taken in its cultivation." Under these conditions, efforts at introducing improved methods of cultivation or production will prove of no immediate avail, and steps should be taken for finding outlets for the lac already being grown, if not by export to foreign countries atleast by industrial utilization in India.

That this aspect of the matter has not been over-looked by the Ranchi workers, is shown by the following extract from the Annual Report of the Indian Lac Research Institute for 1931—32:— "The state of the lac industry has not been satisfactory during the year; in spite of low prices, a steady decrease in exports has to be noted. General trade depression cannot be accepted as the only cause of this, as figures for synthetic resin production for some time past have shown a steadily increasing trade, in most cases at the expense of the natural resin industry………… In recent years, there has been a growing need for research on the technology of shellac and the problems of its marketing and industrial uses………… It was felt, therefore, that the policy of concentrating on the biochemical problems of lac should be modified. Efforts were accordingly made to round off most of the biochemical investigations and to start new problems of more immediate value to the industry. The possibilities of developing new uses for shellac have been given active consideration."

It is gratifying to note that the Imperial Council of Agricultural Research has taken up this aspect of the matter seriously, and has sanctioned funds for deputing three officers to England for training in research in the industrial applications of lac, with special reference to the manufacture of paints and varishes, plastics and electrical appliances. It is well known that America has till very recently been the main importer of Indian lac, and has been utilising most of it in the manufacture of gramaphone records and electrical appliances; and it is satisfactory to note that Government have in view the extension of the scheme to America.

Industrial applications of Lac. The wide scope for the industrial utilization of lac in India will be evident from the following list of the varied uses to which lac has been put, both in India and in the west. The lac industry is amongst the most ancient of the minor industries of India. In the Ain-i-Akbari issued by Akbar in 1590, a note is given on the proportions of lac resin employed in the varnishes used for the wood-work of public buildings. According to Sir George Watt, the Palas tree (*Butea frondosa*), which is a common lac-host in Northern India, is referred to in Atharvaveda as "laksha" and in later Sanskrit literature as "Lakshataru" (lac tree). Misra (1923) quotes other references to lac from ancient Indian literature. It has been already mentioned that before the advent of aniline dyes, the lac-dye was popular and was exported in large quantities to western countries. Among industrial applications in India, Stebbing (1907) mentions the following:—"In the village it is used either as a varnish or colour medium in the production of tables, bed posts, chairs, boxes, platters etc. The silver and copper-smiths employ it in their trades, as do the manufacturers of shields, swords etc., which are varnished over with lac. The material is employed in the manufacture of painted pottery in Bengal, Gonda, Lucknow, Oudh, Peshawar and the Punjab. It is used by jewellers and also in the manufacture of the various classes of bangles worn by the lower classes. Lastly, in the large class of toys of every description made in India, lac is extensively used for colouration purposes, whilst marbles, pens, sealing wax, ink bottles, imitation fruit and flowers are entirely made of it." But it has to be admitted that the quantity of lac at present consumed in India is very small as compared with that exported, and the main impetus for the development of the lac industry has been given by the export demand, in relation to which India has been content to be a supplier of raw material.

In the western countries, besides the large-scale application which lac finds in the manufacture of paints, vernishes, plastics, gramaphone records and electrical appliances, lac is used for the preparation of polishes, gums, cements, sealing wax, lithographic inks, as stiffening material in the manufacture of silk, felt and straw hats, mixed with mica as insulating material etc. High grade lacs are used for aeroplanes, as inside lining for shells, pianos, furniture, boot finish manufactures, emery wheels, brushes, for lacquering metals and cables, as blinding agent for moulding compositions etc.

Among other uses for shellac, Misra (1923) mentions the following:—"Shellac is used for making milk-churns, shuttles and bobbins; for making grinding stones; for fixing hafts to swords; for the manufacture of micanite, with alternate layers of shellac and mica dust; as a substitute for leather, canvas and shellac being used for the manufacture of shoe-tips; for semaphore signalling and as a filling material for sharpnels; for silvering backs of mirrors; in confectionery as a cover to chocolates; for painting the bottom of ships to prevent the corrosive action of the water on the steel-plates; for encasing cable wires, etc. Bleached shellac is used for making imitation ivory used in the manufacture of billiard balls, backs of brushes, combs, tooth-brushes, poker-chips etc., for all white insulated goods and for the manufacture of paper and leather varnishes." Besides its value as a dye, lac-dye has been found to posses good manurial value when applied to land.

Lindsay and Harlow (1921) quote the following uses for lac in America:—"Abrasives and emery wheels, varnishes and polishes of all descriptions, billiard balls, moulding and picture frames, saws, glazed paper, photographic supplies, musical and optical instruments, watches, leather, oil-less beeswax, guns, oil-cloth, paper-board, lead pencils, paints and glass, tiles, automobiles, sealing wax, hats, rubber tires, chemicals and drugs, phonograph records, pianola rolls, composition materials, electrical apparatus of all sorts, brushes and brooms, horse shoes, buttons, lacquer, foundry supplies, bottle tops, fly-papers, hardware, toys, sports-goods, typewriters, cements and glues, cutlery, mirrors, jewellery, confectionery, engravers' supplies, mint supplies and fire-works." It is estimated that 40 to 50% of the entire demand is on account of gramaphone records that other individual industries cannot claim more than 5 to 8% each of the total consumption.

What with the low prices prevailing now, the advent of synthetic lac on the market, the disorganised condition of international trade and the gloomy prospects ahead, only a vigorous policy of development of the industrial utilization of lac within India, can hope to save the lac industry from the complete demoralisation and annihilation, such as overtook the indigo and other industries in similar situations in the past.

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THE EFFECT OF PICKING DATE OF PARENT SEED ON SOME ECONOMIC CHARACTERS OF THE COTTON PLANT

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Introduction. The variation in the characters of cotton bolls picked at different parts of the season is a phenomenon familiar to cotton breeders. A gradual and pronounced decline in the values of these characters with the advance of the season is also a common experience. It often happens that seed material obtained from a portion of the picking period is used to raise the subsequent year's crop. A knowledge, therefore, of the influence of these parental variations on the characters of the progeny will be useful, particularly in breeding work on Cotton. Some aspects of this study are presented in this paper.

Characters Investigated. Observations on the following characters of cotton bolls are included in the present study:

(1) Ovules (per lock).
(2) Seeds ,, ,,
(3) Fertility index (% of ovules maturing to seeds).
(4) Seed cotton weight, per seed (in m. gms)
(5) Seed weight, per seed ,, ,,
(6) Lint weight, per seed ,, ,,
(7) Ginning percentage.
(8) Lint length per seed (in m. ms.)

Material and Methods. Culture 54, a pure line of *G. indicum*, was grown at the Agricultural Research Station, Nandyal, Kurnool District during the seasons 1929—30 and 1930—31 for purposes of the present study. During the first year of the experiment, 150 plants in one row of the seed multiplication plot of No. 54 Cotton were marked out for purposes of 'selfing' the flowers. Picking of bolls was done at intervals of three days. The culture was 'selfed' during all generations to ensure genetic purity. Healthy material from three-locked bolls (this category being the most common in the selection) of each harvest was examined for the boll characters. All available locks of each picking date were examined in determining the average number of ovules and seeds per lock. For *Kapas*, seed and lint weights, one hundred representative seeds from each group were taken or as many as were available, if less than 100. For the study of lint length, six third position seeds from random locks were used (Ramanatha Ayyar and Jagannatha Rao, 1930) the method of fibre length determination being the one adopted by Hilson (1923). In order to study the effect of these variations on the characters of the progeny, the seeds from alternate lots of material picked at three-day intervals were sown during the year 1930-31 and the flowers protected from foreign pollen. The seed-cotton obtained from the progeny of each lot was examined for the same set of eight characters.

Results. The appended charts show the variations in the parental characters during the year 1929-30.

The characters, Kapas, seed and lint weights exhibit a gradual fall from the beginning of the season to the end, the respective percentages of decrease being 38, 41 and 41. These observations are mostly in agreement with those of several other workers on cotton. Zaitzev and Gusteva (1928) working on short-stapled Upland cotton observe "that seed-cotton undergoes considerable changes dependent on the age of the cotton plant and that characters such as the weights of seed-cotton, seed and lint per seed decrease with the age". Patel and Mann (1928) working on *Broach deshi* cottons observe: "Generally, there seems to be a marked tendency for both the characters (seed and lint weights) to decrease in the later developed parts of the plant and in the younger parts of branches". Venkatraman (1930) concludes from a study of an *Uppam* (*G. herbaceum*) culture that there is a general tendency for the characters, seed and lint weights, to decline towards the later formed bolls The present writer (1931) has shown a similar decline in the characters, kapas, seed and lint weights, in the case of *Karunganni* cotton (*G. indicum* of Tinnevelly). A perusal of the chart shows that the decline in the case of ginning percentage is not very pronounced. In the investigations of Zaitzev and Gusteva (1928), out-turn of lint decreases with the age of the plant.

As regards lint length also, a fall (11%) is seen to occur in the cotton under study. This is in agreement with·Venkatraman's (1930) finding and opposed to that of Zaitzev and Gusteva (1928).

The data pertaining to ovules and seeds per lock do not show a decline from the beginning of the flowering phase towards later stages, but a rise accompanied by a decline in value is seen. Venkatraman (1930) finds no effect on these characters with differences in the flowering period.

In Table 1 are presented the parental and the progeny averages pertaining to the several lots of seed sown during 1930-31 and Table 2 shows the parental and the progeny general means and standard deviations for each character.

As opposed to the wide variability of the parent, it is seen that the progeny characters vary only to a limited extent. Although the parental values chosen for sowing varied from 80—54, 55—37 and 26—17 m. gms. per seed in the case of *Kapas*, seed and lint weights respectively and 7·0—6·2 and 6·8—5·8 ovules and seeds per lock, the variation in the case of the progeny characters is seen to be very low. The corresponding ranges are 72—69, 52—49 and 22—20 m. gms. per seed and 6·5—6·1 ovules and 6·1—5·8 seeds per lock, respectively.

These figures together with the general means and standard deviations cited in Table 2 clearly show that the progeny averages of the characters regress towards the means of the respective parental characters irrespective of the character of the seeds sown. The seasonal influence has modified the means to a slight extent in the case of some characters such as ovules and seeds per lock and seed and lint weights. The seasonal and environmental factors affect the values of any character of the progeny of a pure line in a plus or minus direction, though during any given season some characters are affected in a positive and some in a negative direction while some are not influenced at all.

Conclusion: For purposes of the study of economic characters in breeding work on cotton, it often happens that only a portion of the plant produce usually at the time of heavy picking is gathered for the study of characters and for the subsequent sowings. The result that the picking date of parent seed has no effect on the progeny plant is in the welcome direction and this knowledge can be made use of in purification studies.

Summary. An experiment conducted at the Nandyal Agricultural Research Station during the two seasons 1929—30 and 1930—31 to see the effect of picking date of parent seed on some economic characters of the progeny plants in a pure line of *indicum* Cotton has shown that:

(1) the boll characters like *Kapas*, seed and lint weights distinctly decrease in value as the season advances, while lint length and ginning percentage show only a slight falling off;

(2) in the case of ovules and seeds per lock, the decline is preceded by a rise;

(3) the high or low parental value occuring as a seasonal variation has no influence on the progeny average, and

(4) except as modified by the seasonal and environmental influences surrounding the progeny, the average of the off-spring tends to regress to the mean value of the parent.

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Table 1.

Parental & Progeny Averages.

Parental picking date	Ovules per lock		Seed per lock		Fertility index per cent.		Seed-cotton weight per seed. m. gm.		Seed weight per seed m. gm.		Lint weight per seed. m. gm.		Ginning percentage.		Lint length m. m.	
1930	Parent	Progeny	Parent	Progeny	Parent	Progeny	Parent	Progeny	Parent	Progeny	Parent	Progeny	Parent	Progeny	Parent	Progeny
23/1	6·7	6·3	6·3	5·9	94	94	80	71	55	50	25	21	31	30	26	25
29/1	7·0	6·5	6·8	6·1	97	94	77	71	51	50	26	21	34	30	26	25
4/2	6·4	6·2	6·3	6·0	98	97	79	72	55	50	24	22	30	31	26	25
10/2	6·2	6·1	6·0	5·8	97	95	74	69	53	49	21	20	28	29	25	25
16/2	6·7	6·1	6·4	5·8	96	95	70	70	48	49	22	21	31	30	25	25
22/2	6·6	6·1	6·4	5·9	97	97	69	72	48	51	21	21	30	29	25	25
28/2	6·6	6·1	6·1	5·8	92	95	66	72	45	50	21	22	32	31	24	25
6/3	6·7	6·1	6·3	5·9	94	97	57	72	39	52	18	20	32	28	24	25
12/3	6·3	6·3	5·8	5·9	92	94	54	71	37	50	17	21	31	30	24	25

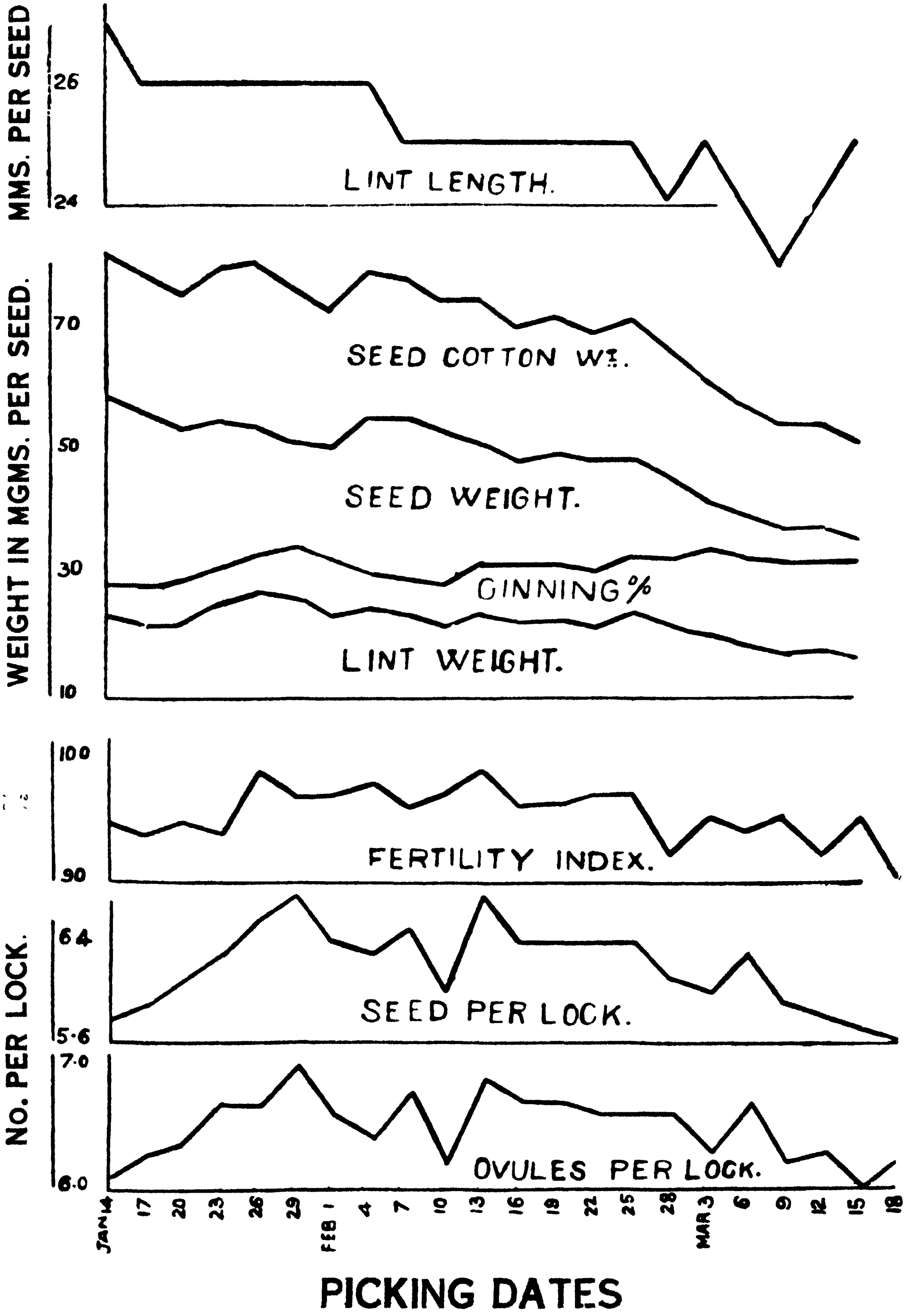
Table 2.

Parental & Progeny general means & standard deviations.

Character	Parent. 1929—30.			Progeny. 1930—31.		
	Average	Standard deviation	Coeff. of variability	Average	Standard deviation	Coeff. of variability
Ovules per lock	6·50	± 29	4·4	6·24	±0·15	2·4
Seeds per lock	6·20	± ·33	5·4	5·91	±0·14	2·4
Fertility index	95·50	±2·55	2·7	95·50	±1·73	1·9
Seed-Cotton weight	70·26	±9·52	13.6	71·06	±0·90	1·3
Seed weight	48·74	±7·09	14·5	49·94	±0·90	1·8
Lint weight	21·69	±3·03	14·0	21·06	±0·90	4·3
Ginning per cent.	30·81	±1·69	5·5	29·78	±1·00	3·3
Lint length	25·26	±0·90	3·6	25·00	Nil.	Nil.

VARIATION IN PARENTAL CHARACTERS.

(1929-30)



INDIAN CANES IN SOUTH AFRICA

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On my way down the East-coast of Africa I visited the experiment station of the South African Sugar Association at Mount Edgecombe, and I thus had an opportunity of learning something about the research work being done on sugarcane in the Union. In the course of my stay at Durban I also saw, in a general way, the agricultural conditions prevailing in the main sugar-cane growing area in Natal.

It will be remembered that the Uba cane, which is the only variety grown on any scale in South Africa, was imported some years ago from Northern India, and my visit was of interest in providing an opportunity of seeing the conditions under which this Indian cane has become acclimatised and grown almost to the exclusion of all others. Recently a number of Coimbatore seedlings, which are closely related to the class of cane to which Uba belongs, have been under trial, one of which has already been released for cultivation, and although it is rather early to say how far these seedlings are likely to replace Uba, there is every reason to believe that the work at Coimbatore will be of great value to the industry in South Africa.

In Natal, the hot weather extends from September to May, when the atmospheric temperature rises up to 100 degrees in the shade, but generally the maximum does not exceed 95 degrees. The annual normal mean temperature is about 67 degrees, and in July ground frosts are not uncommon. The rainfall varies from 35 to 50 inches, about 65 to 70 per cent. of which falls between the months of August and May. The rainfall therefore is well distributed, and more so than in South India.

The sugarcane belt extends approximately from Port Shepstone to Umfolosi, a distance of about 250 miles. On the South coast, in the neighbourhood of Durban, sugarcane is cultivated on undulating hills in marked contrast to South India, and such conditions may be said to be fairly typical. Many types of soil appear to be represented, but deep sandy loams preponderate. Although the surface geology of Natal generally is formed by shales, conglomerates, and sandstone, there is an almost universal distribution of volcanic rock, the disintegration of which has resulted in enriching what would otherwise be a poor soil.

To those who desire more detailed information regarding climatic conditions in the area with which we are concerned, and detailed information about the growing of sugarcane and the manufacture of sugar, the South African Sugar Industry Year Book will be found useful. But this note will be confined to a few observations which may be of interest to those who are studying the economics of sugarcane cultivation, particularly in relation to the class of cane represented by the new Coimbatore thin seedlings. The cultivation of what may be termed " a poor man's cane " has received increasing attention in recent years in the I Circle * which has necessitated somewhat drastic changes in methods of cultivation, manuring, and irrigation. Although conditions in Natal are very different to those prevailing on the Eastcoast of the Madras Presidency, experience in South Africa, where the crop is grown generally without irrigation, may be of assistance in evolving methods of cultivation suitable for South Indian conditions where thin canes are grown.

In Natal under unirrigated conditions, except on land that recieves seepage, sugarcane takes 20 to 24 months to mature, whereas on the heavier class of soil under irrigation the period is only 8 to 12 months. In the former case the crop stands through a period of light rainfall in June, July, and August amounting on an average to about 3·5 inches, and during the latter month the mean daily temperature is about 60 degrees. These local conditions cause growth to be stationary, and a comparatively dry period at a time when atmospheric temperatures drop, does not cause flowering or any other indication of ripening.

The distance of planting is usually four and a half to five feet, and owing to the long period no difficulty is experienced in providing immature cane for seed purposes. Setts are left untrashed, and are usually nine to fifteen inches in length, and although ants are a pest, this practice does not appear to cause appreciable loss. The condition of the canes generally, as might be expected, is superior to those grown under typical wet-land conditions in S. India.

Although deep ploughing up to twelve inches is generally considered preferable to more shallow tillage, large areas are planted in less depth of tilth. Furrows are opened in the usual manner by the use of double mouldboard ploughs. There appears to be some doubt about the effect of depth of planting on germination and the vigour of the plants, and I learnt that setts are put down at a depth varying from one to six inches. The wide variation in types of soil to which I have referred is doubtless one cause of these differences. Light multiple-tined single row cultivators are in general use, and weeding by hand is done in the lines.

It is usual to take from four to six crops in succession, but no general rule appears to be recognised. On the bigger estates when the tonnage falls below a given figure, the land is ploughed up and put under a green manure crop for a period of one year, and subsequently again planted to cane.

In view of the relatively small number of live stock, supplies of manure, as in parts of S. India, are scanty. Commercial or artificial manure is in almost general use, and is applied in the form of complete

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fertiliser at the rate of from 400 to 800 lbs. per acre. On the experiment station at Mt Edgecombe a normal dressing consists of 480 lbs. super, 120 lbs. ammonium sulphate and 60 lbs. potassium chloride, per acre.

Under estate conditions an average yield of 20 to 25 tons of stripped cane per acre is usual, although under the best conditions over 30 tons may be obtained. The juice analyses out at about 13 per cent. sucrose.

At the present time a number of Coimbatore seedlings are under comparison with Uba under unirrigated conditions. In 1930-31, Co 205 and Co 210 were both found to be superior to Uba in yield of sugar, the former by 18 and the latter by 14 per cent. The thicker seedlings, however, show more promise, and a recently harvested crop of Co 281 gave a difference in yield of sugar over Uba amounting to 26·6 per cent. Co 213, up to date, has not proved superior to Uba either in tonnage of cane or yield of sugar. In a recent quantitative trial of a plant crop Co 290 gave 33 tons of stripped cane per acre, or 20 per cent over Uba and 31 per cent more sugar.

It will be seen that good yields have been obtained and that only 25 lbs. nitrogen per acre is used compared with about 100 lbs. under our conditions. It may be noted here that as a result of experience on the station at Anakapalli, the quantity of manure applied for some Coimbatore seedlings has been progressively reduced, and unirrigated crops of Co 213 on wet-land have yielded up to 30 tons of cane per acre In one case the quantity of nitrogen applied per acre was no more than 28 lbs.

I saw a number of crops of Coimbatore seedlings including Co. 290. At Anakapalli Co. 290 and Co. 281 on wet land both tend to grow tall and to develop a spreading habit even under restricted irrigation, but in Natal these canes grow to a height of about 10 feet only and show no inferior habit. This may be attributed to slow growth, absence of irrigation, light manuring, and to a less extent wide spacing.

A series of inoculation experiments to test the susceptibility of certain of the Coimbatore seedlings to mosaic disease are in progress, and although incomplete, useful information has already been obtained. The preliminary tests at the Herbarium in Durban are being continued under field conditions. Over a period of three years Co. 290 has proved to be almost entirely immune, although Co 281 and Co. 314, and particularly the latter, have been found to be susceptible.

Experience at Mount Edgecombe shows that none of the P. O. J. canes that have hitherto been tried, which include P. O. J. 2714, P. O. J. 2725, P. O. J. 2727 and P. O. J. 2878, are suitable for unirrigated conditions.

Notes and Comments.

New Year Honour to Principal Tadulingam. We have very great pleasure in offering our hearty congratulations to our College Principal Mr. C. Tadulinga Mudaliar on the title of 'Rao Bahadur' conferred on him by the Government. As the seniormost among the officers at the Institute and as one of the few who were attached to the department when it was re-organised in the early years of the century by pioneers like Dr. Barber and Mr. Benson, Mr. Mudaliar had earned a claim to such honours long ago. We are, however, glad to note that the Government has been pleased to recognise his claims and honour him now. We also extend to the "Rao Bahadur" as the President of our Union our special congratulations and good wishes and pray to God that he may be spared to live for many more years and receive further honours.

Lac Research in India. Most of our readers are, perhaps, aware, that the great bulk of the world's demand for 'shellac' (the manufactured product from 'lac' secreted by the lac insect) is supplied by India and that our country practically holds the monopoly in the production of this commodity. But for the past ten or twelve years the industry has not been thriving quite satisfactorily due to various factors. With the idea of restoring its old position and placing it on a better foundation, research work on the different aspects of the industry has been conducted in different institutes like the Forest Research Institute, Dehra Dun, the Indian Institute of Science, Bangalore, and especially in the Indian Lac Research Institute, Namkum, Ranchi (Behar and Orissa). From the latest report of the Director of the Ranchi Institute it is found that the state of the industry has not been very encouraging during the year and that as in other industries shellac is being threatened by synthetic products thus necessitating the discovery of and developing new uses for shellac and carrying on other experiments to combat this menace. In the opinion of the Director, action has to be urgently taken "if the lac industry is to regain some of its former position in the world's markets". We understand that the Indian Lac Cess Committee which took over control of the activities of the Ranchi Indian Lac Association last year is now considering ways and means to revive the industry and this is evidenced by the fact that they have recently advertised for young men with high qualifications in Physics and Chemistry to offer themselves as research scholars for special training in Europe on decent scholarships in the different aspects of the industry. We hope such activities will help to give fresh life to this ancient industry and restore the product to its original place in the world's markets. We would invite the attention of our readers to a short and interesting paper on this subject appearing elsewhere in this issue.

Agriculture at the Indian Science Congress. Out of a total of 73 papers read before the Agricultural section of the Patna Science Congress the following papers refer to subjects connected with or worked out in S. India.

1. "Determination of Nitrogen in soil" by Mr. A. Srinivasan, Bangalore. 2. "Lodging of straw and its inheritance in rice" by Messrs. K Ramiah and S. Dharmalingam, Coimbatore. 3. "Chromosome studies in some species of Crotalaria" by Messrs. S. Ramanujam, N. Parthasarathy and K. Ramiah, Coimbatore. 4. "A biochemical study of the *ragi* plant as affected by mineral treatments and seasonal factors" by Messrs. S. Rajagopal and A. V. Varadaraja Ayyangar, Bangalore. 5. "The plate method of counting soil population" by Mr. S. Rajagopal, Bangalore. 6. "Experiments on the root-gall nematode in S. India" by Mr. P. N. Krishna Ayyar, Coimbatore. 7. "Insect pests noted on oranges in Northern Circars" by Mr. V. Margabandhu, Coimbatore 8. "Some important insect problems connected with the cultivation of rice in S. India" by Dr. T. V. Ramakrishna Ayyar, Coimbatore. 9. "Kole cultivation of paddy in Cochin with special reference to insect pests" by Mr. C. S. Venkatasubban, Cochin. 10. "Hymenopterous parasites of economic importance in S. India" by Dr. T. V. Ramakrishna Ayyar and Mr. V. Margabandhu, Coimbatore. 11. "Cold storage of mangoes" by Messrs. B. N. Banerjee and G. Ramakrishna, Rao, Bangalore.

The President of the Agricultural Section is Mr. Afzal Hussain, M. A., M. Sc., Government Entomologist, Punjab.

Some New Features Proposed for our Journal. With the beginning of this—the twenty-first volume of our journal—it is the intention of the editorial board, with the co-operation of our contributors and well-wishers to add a new feature to the journal and thereby increase its usefulness to our readers, especially to those interested in agricultural matters. It is our idea to publish periodical information regarding crop and trade returns and thereby keep ourselves up-to-date on matters regarding agricultural products and their disposal. It is hoped that this addition will, in the long run, help those interested in agricultural and trade statistics and make our journal a useful reference medium. Contributions, suggestions and criticisms are invited from our readers.

Health of Dr. C. A. Barber. We are very much pained to peruse a letter written by Mrs. Barber from England to one of her correspondents at the Agricultural College giving information about the present unfortunate condition of Dr. C. A. Barber. Dr. Barber who was for several years Government Botanist in Madras Service and later Sugar Cane Expert to the Government of India and who is now 73 years old, has been in failing health for the past two years; and though he rallied a little, he is now reported to be completely bed-ridden and helpless. To all friends of Dr. Barber and to those who have had the privilege of working with and knowing him the letter will be found very pathetic and moving. We can only convey our sincere sympathies to Mrs. Barber and her children and pray to God to give them sufficient fortitude and patience during this unfortunate period of trial and suffering.

All-India Poultry Exhibition and Conference. We understand that the 20th All-India Poultry Exhibition will be held in the Qudsia Gardens, Delhi, on the 28th, 29th and 30th January, under the patronage of His Excellency Lord Willingdon, Viceroy of India. His Excellency the Governor of Bengal, H. E. the Governor of the United Provinces and H H. the Maharajadhiraj of Patiala. The second All-India Poultry Conference will also be held in connection with this exhibition on the 27th and 28th instant. His Excellency the Viceroy will preside at the prize distribution. Lady Willingdon has accepted an invitation to visit the show. Entries will close on the 15th instant and intending exhibitors have been requested to get the particulars from the Honorary Secretary, Indian Poultry Club, 2. Peel Road, Lucknow.

Gleanings.

The Enzyme theory of Virus Disease. Evidence that the so-called "Virus diseases" of plants and animals are caused by a non-living chemical substance that can attach itself to living matter, rather than by ultra-tiny living organisms, is claimed, as the result of experiments on tobacco plants performed by Dr. Carl G. Vinson of the University of Missouri. Dr. Vinson's work apparently supports the belief, held on theoretical grounds by many physiologists and pathologists during the past 30 years, that the causes of these mysterious diseases of plants and animals are compounds analogous to enzymes, the digestive and respiratory "ferments" of normal organisms, but malefic rather than beneficient in their effects. Virus diseases afflict almost all plants. Their symptoms are such things as leaf mosaic, leaf curl and Yellows. Animals and man also have virus diseases; among them are small-pox, infantile paralysis and hog cholera. The causal agents of these diseases have never been positively identified as visible, and whatever they are, they will pass through the pores of a stone filter and come out on the other side still virulent, which is something that ordinary disease germs, visible under a microscope, could not do. Dr. Vinson's method of isolating the virus of tobacco mosaic was worked out during four years he spent at the Boyce Thompson Institute for Plant Research at Yonkers, N. Y., prior to coming to the University of Missouri. The first step was to freeze a quantity of mosaic infected tobacco plants. Then the dead plants were put under heavy pressure, squeezing out their juice. Samples of this juice, filtered free of large particles, caused leaf mosaic when injected into healthy plants. The virus was thus evidently in the juice. The next step was to separate the juice into its various components and find which of these could cause the disease and which could not. This Dr. Vinson did by adding acetone to the cold juice. This brought down a solid precipitate. The liquid left after precipitation could no longer cause the disease, but a solution of the precipitate could do so. The virus was thus evidently in the precipitate. Dr. Vinson's further work has been in the greater refinement and purification of the precipitate, each step obtaining a more concentrated form of the virus. He states that analyses indicate the chemical make-up to be that of a protein or of some compound very similar to proteins. It is regarded as probable, however, that not the whole protein molecule is the real mischief maker, but some relatively simple group of atoms that is attached to other protein molecules in healthy protoplasm, thus providing a mechanism of infection and propagation. Dr. Vinson's work will of course be regarded agnostically by many of his colleagues, and all the results will be held provisional until the experiments are repeated and checked by other researchers. But if these checks confirm his theory, and extend it to apply to other virus diseases of both plants and animals, the effects of this research may well be very far reaching. They will give a new physiological picture of many diseases that have hitherto baffled understanding, and perhaps pave the way for more effectual warfare against them. (*Science News* in '*Science*', September 16, 1932).

Germany Producing Sugar From Waste Wood. A new use for waste wood from forests is reported by the Deutsche Bergin Actien Gesellscheft fur Kohle and Esdoelchemie, at Rheinan, near Mannheim. The company has departed from its former field of activity, the hydrogenation of coal and oil, and is now occupied with the producing of sugar from waste wood in forests. The technical side had been considered solved for some time, both as regards the manufacture of fodder products and fodder mixtures, and the further refining of the "wood sugar" to grape sugar or dextro glucose. The economic success of the process also appeared to be assured in itself, but further developments depended upon a favourable wood price, upon a successful public introduction of the new and cheap fodder, and finally the financing of extension of the Rheinan plant, or the erection of new large factories elsewhere. The "wood sugar" produced by the process of the company is regarded as a cheap basic material for the production of yeast alcohol, and other products of fermentation. (*Chemistry and Industry*, 1932, Vol. 51. P. 727)

Salt in Water-Quantities tolerated by Horses, Cattle and Sheep. (1) Horses will thrive on water containing 400 grains common salt and 550 grains total solids per gallon, and, provided they are not worked, may be sustained on water containing up to 638 grains salt and 950 grains total solids. Water containing as much as 798 grains salt and 1,022 grains total solids has been used for a period of three months without ill-effects. (2) Cattle will thrive on water containing 800 grains common salt and 1,000 grains total solids, but when the concentration reaches 970 grains salt and 1,300 grains total solids they are injuriously affected. (3) Sheep will thrive on water containing 800 grains common salt and 1000 grains total solids, and will do well even up to 1,197 grains salt and 1,350 grains total solids. When the concentration reaches 1,277 grains common salt and 1,868 grains total solids the sheep are injuriously affected. (R. H. F. Macindoe in the *Journal of the Dept. of Agriculture, South Australia*, November 1932).

Another Vitamin? At a meeting of the Biochemical Society on June 11th, L. W. Mapson read a paper entitled "Evidence of a Dietary Principle Stimulating General Growth and Lactation". He showed that a substance is present in fresh ox-liver which stimulates the growth of rats maintained on a full synthetic diet to approximately twice the normal rate of the control animals. The lactation of the females was also stimulated. This growth promoting principle is distinct from the Knans accessary food factors. Whether the substance active in promoting the growth rate is identical with that stimulating lactation remains to be determined. A peculiar point is that the growth response has been transmitted from parent to offspring by the feeding of liver to the parents, the stimulation of growth being greater under such conditions than where the liver is fed directly to young animals—(*Chemistry and Industry*, 1932, Vol. 51, p. 535)

Indian Pulp and Paper Industries. (Extract from the Report of the Indian Tariff Board on the grant of Protection to the Paper and Paper Pulp Industries.)

The total consumption of paper (including pasteboard) in India increased from 111,963 tons in 1924—25 to 175,627 tons in 1929—30, but fell to 154,277 tons in 1930—31, and of these quantities the Indian mills have steadily supplied from 22 to 24 percent. The consumption of paper of protected classes increased from 43,331 tons in 1924—25 to 53,584 tons in 1929—30 but fell to 49,046 tons in 1930—31, and of this paper the Indian mills supplied from 53 to 71 percent. There are now nine paper mills working in India, the total output of which in 1930-31 amounted to nearly 40,000 tons. There has been a large increase in the use of imported wood pulp by the Indian mills and this is attributed partly to the fact that the financial aid proposed by the Tariff Board for the development of bamboo was not granted and partly to the fall in the price of wood pulp. It has led to an annual expenditure of about Rs. 20 lakhs on Indian materials and labour which would otherwise have been spent on imported paper. The additional market for paper in India which the Indian mills may expect to capture is about 20,000 tons per annum, apart from any normal increase in consumption. Bamboo is available in India and Burma in sufficient quantities not only to supply the entire Indian demand for pulp, but also to develop a large export trade. Air-dry bamboo which cost about Rs. 55 per ton in 1924—25 is now obtainable at Rs. 38—40 or even less. Considerable progress has been made regarding the mechanical treatment of the bamboos and further experiments are being undertaken. The digestion of the material is effected by the acid sulphite process at the India Paper Pulp Company's mill at Naihati and by the alkali process (usually with fractional digestion) at the other mills. The bamboo paper has proved to be of satisfactory quality for most purposes. The future of the Indian paper industry depends on the exploitation and development of bamboo and it is anticipated that paper made from it will eventually be able to dispense with protection; grass also occupies a recognised place in the industry, and should be subject to the same proposals for assistance. The withdrawal of the protective duty at the present time would lead to the disappearance of bamboo as a paper-making material and this would be a national loss; it would cripple the resources of the Indian mills and endanger their existence. Direct encouragement for the development of bamboo could most suitably be afforded by the imposition of a duty on imported pulp, which should be fixed at Rs. 45 per ton. The duty on paper should be continued at the present rate of Rs. 140 per ton or one anna per lb. These duties should remain in force for a period of seven years. The duty on paper should be applied to printing and writing papers which are now liable to the protective duty, and no alteration should be made in the existing Tariff entries regarding newsprint and packing paper. Although some progress has been made towards the Indianisation of staff and with apprenticeship schemes, the principal mills have not made sufficient effort to attract and offer employment to Indians, especially in the paper-making section of their works, and this matter should receive early attention. Steps should be taken to develop the Paper Pulp Section of the Forest Research Institute at Dehra Dun, with the object of co-ordinating the experimental work carried out by the mills. (*Bulletin of the Imperial Institute* Vol. 30, page 199).

ABSTRACTS

Silage Investigations at Bangalore.—Effect of the stage of Maturity on the Ensilage of Jowar. T. S. Krishnan (*Agriculture and Live-Stock in India.* 1932, Vol. 2, Part 5, pp. 507—514). In the previous two papers (1930: *Memoirs Dept. Agr. India*, Chem. Ser. Vol. 10, No. 10 and 1931: *Ind. Jour. Vet. Sci and Animal Husb.* Vol. 1, pp 259—282) the author has reported the chemical changes occurring during the ensilage of *jowar* (*Sorghum vulgare*). In the present paper he examines the influence of the stage of maturity of *jowar* on the quality of silage obtained, and on the nature of chemical changes taking place. Jowar was ensiled at three different stages of maturity:— (1) Immature, ie, when all the leaves had appeared but the plant had just not flowered, (2) Prime, ie, when the grains in the earheads were just hardening, and (3) Straw stage, ie, the dead ripe residue left after the earheads had been removed. It was found that:— (1) Ensilage at the immature stage produced a silage of good colour and texture, but of an unpleasant acid smell, due to the butyric acid; it was "acid" or "sour" silage. A large proportion of the protein (44·2% of true protein) was lost; there was a marked decrease in the amino-acid content (from 2·86% to 0·99% on dry matter) but there was an appreciable increase in the volatile bases from 0·12% to 6·10%, and in amides, which increased by 88% on the original amount. Organic acids also show marked increase from 2·67% to 7·26%, the whole of it being volatile acids. There is marked loss in inorganic constituents (about 10% loss on the original amount), mainly phosphorus and calcium. (2) Ensilage at the prime stage yielded a silage of good colour and texture, which can be called "acid brown silage", and had a very pleasant smell and was eaten by cattle with great relish. In regard to chemical changes, the losses were the least at the "prime" stage; only 28·4% of the true proteins were lost, and the amino acid content actually showed an increase from 1·58% to 2·13%. The increase in volatile bases was from 0·24% to 1·26% and the amides increased by 77·1% on the original amount. The organic acids increased from 1·60% to 4·67%; 6·9% of the crude fibre was lost and the loss in inorganic constituents was inappreciable. (3) Ensilage at the "Straw stage' gave a material of a very fine texture and pleasant pungent acidic smell; it was readily eaten by stock and can be named "acid brown' silage. In some respects, the chemical changes at this stage resembled those at the "immature" stage, there being a slight loss in amino acids (from 1·06% to 0·78%), increase of organic acids (from 0·24% to 4·06%) and appreciable loss of inorganic constituents (about 10% on the original amount) chiefly phosphoric acid, but in other respects, this silage is superior to that obtained from "immature" jowar. There is only a small loss of true protein (12·7% on the original amount) and a slight increase in volatile bases (from 0·12% to 0·35%, while the proportion of non-volatile acids is much higher (1·70%). The author therefore concludes that the immature plant (stage I) is quite unsuitable for silage and that the prime stage (stage II) produces the best silage with the least loss. (C. N.)

2. **Watering and Spacing Experiments with Egyptian Cotton.** Templeton J. (*Bull No. 112 of The Ministry of Agriculture, Egypt*). The general practice in cotton cultivation in Egypt to-day is to stop watering for a period of from 6 to 8 weeks after sowing which is generally done in March—April. The explanation for this practice lies in the fact that in the early days of cotton cultivation in Egypt, water shortage was liable to occur during the hot months of June and July, i.e., before the arrival of the Nile flood, and by stopping the water supply shortly after sowing, the seedlings were forced to develop deep root systems which could draw on the sub-soil water in the succeeding dry period. The harmful effect of this practice lay in that a good percentage of the early flower buds were shed and lost. This loss was in former years to some extent

made up by allowing the fruiting season to extend up to December, but recently with the advent of the Pink boll worm, all later pickings are destroyed by the pest and thus the growing season has been curtailed. The author observes that there is no justification now for the artificial stopping of water supply in the early period, with attendant modification of the root systems, since the danger of water shortage in June and July has long ago disappeared, owing to the great developments in irrigation in Egypt by construction of dams and barrages across the Nile. As the author points out, the continuance of the old practice, long after the necessity for it has disappeared, has resulted in an artificial decrease in yields; and in view of the advent of the Pink boll-worm in November and December, efforts should be made to bring out the crop earlier. With this view the author has carried out various watering and spacing experiments, which show that by watering three weeks after sowing, combined with heavy watering at the beginning of July, the crop is earlier and increased yields are obtained. Spacing experiments show that with closer spacing the crop matured earlier and the optimum spacing was found to be 35 c. m. between the holes and 65 c. m. between the ridges as opposed to 45 × 75 c. m. in pre-bollworm days. (C. N.)

3. **Production of Papain from the fruit of the Papaya Tree**, *Carica Papaya*. By the Principal, Harcourt Butler Technological Institute (*Agriculture and Livestock in India*, 1932, Vol. 2, Part v. pp 47—489). As the author points out, there is good scope for increase in the area under papaya cultivation in India, especially near towns, both for sale of the fruit and for the manufacture of papain, a medicinal preparation rich in enzymes, chiefly proteolytic. Papain can be prepared in a simple manner by cutting the outer skin of the fruit before it is fully ripe when a white milky fluid exudes, which is collected and dried to a white non-crystalline powder, which is commonly sold as papain. The fruits are "lanced" at intervals till no further papain exudes, and then allowed to ripen for sale; thus the same fruits can be used both for sale as well as for the preparation of papain, though the removal of papain lowers the market value of the fruits. A considerable industry in the production of papain exists in Ceylon. In 1927 and 1928, the value of this material exported from Ceylon was Rs 6,71,000 and Rs. 5,33,000 respectively; the average price of export in the years 1925—28 was in the neighbourhood of Rs. 8 per pound. The cultivation of papaya on a commercial scale was tried in the grounds belonging to the Harcourt Butler Technological Institute, Cawnpore, and the author gives details regarding the laying out of a plantation, extraction and treatment of the juice, methods for grading the product and costs of production. Though the actual costs incurred were higher, due to experimental side investigations, the author estimates that on a ten acre plot devoted to papaya cultivation a net profit of Rs. 5000 can be had after the second year from date of sowing; in the first two years the total expense of bringing the plantation to bearing viz. about Rs. 7500 is recouped by an income of Rs. 8,700, leaving a net profit of Rs. 1200 for the first two years. (C. N.)

4. **Ready Reckoner Tables in Animal Nutrition**. By A. K. B. Cazi (*Agriculture and Livestock in India*, 1932, Vol. 2, part 5, pp 490-498). In the words of the author, " this article which embodies four tables, is intended to enable practical farmers to read off at a glance the various nutritional requirements of animals of different weights and under different states and degree of production with the exception, of course, of those that are still at the suckling age." Table I gives the starch equivalents and digestible proteins for adult dairy animals of different weights, yielding different quantities of milk; a correction for excess of fat in milk above 5% is appended. Table II gives the starch equivalents and digestible protein of working bullocks of different body weights, working for different hours per day on light or medium work (such as carting, harrowing, hoeing or interculturing, ploughing on light sandy soils etc.). Working bullocks

on heavy work (such as ploughing on medium or heavy soils or deep ploughing in the case of light soils, trotting, lifting water etc.) are recommended to be given 10% more nutrients than for light work. Table III gives the nutritional requirements of young growing animals at different ages, for maintenance plus growth at normal rates. Table IV gives the starch equivalent and digestible protein, the ratio of S. E. to D. P. and price per unit S. E. for various farm food stuffs like green fodders, straws, husks, brans, silage, grains, oil seeds, oil cakes, animal products etc. The formulae from which the figures given in tables I to III have been calculated are not given. Except for table IV, whose figures are averages of values given by Kellner, the authority for the figures given in other tables is not quoted; it is not stated whether the figures represent experimental results obtained under Indian conditions with Indian cattle, which are known to require less digestible protein then western breeds. (C. N.)

Review.

Tanjore Rice for Ceylon. A Special Report by Mr. N. S. Kolandaiswamy Pillai, Dy. Director of Agriculture, Trichinopoly:—Though a very large area, nearly a million acres, under rice is concentrated in the Tanjore district, the total output is only 6,31,791 tons of which 1,62,682 tons or nearly 25% is available for export from the district. Of this quantity, about 40% is exported to Ceylon, the rest finding a market in parts of Malabar and the Tamil districts. Although there is a general impression that Burma has captured the Ceylon rice market from Tanjore, the report mentions that it is hardly the fact in as much as the quantity of Tanjore rice exported to Ceylon is now more than double of what it was five years ago. The slump in the Tanjore rice trade is therefore due, according to the report, to three reasons: (1) general fall in prices, (2) rice from Burma and the northern districts of our own province, Godavari and Kistna, replacing Tanjore rice in the markets of the southern districts, and (3) possible extension of rice areas with a definite tendency for over-production.

Ceylon produces annually 3,63,000 tons of rice, about two-fifths of her requirements, and imports from Burma nearly as much as she produces, the balance being met by imports from Tanjore, Tinnevelly etc. There is a difference of nearly Rs. 3 in the price per bag of 160 lb. in the Ceylon market between the best Burma rice Milchard no. 1, and the Tanjore *Sirumani* rice. Though the Tanjore rice may be better in quality than the Burma rice, on account of the trade depression in the chief commercial products of Ceylon, tea, coffee and rubber, the prosperity of the people has gone down, and the lower and middle classes of the island prefer to go in for the cheaper Burma rice. Moreover Ceylon is herself trying to increase her rice production and within the last 20 years the rice area of the island has gone up by 20%, and the production nearly doubled. This tendency will surely affect her rice requirements from outside sources, Burma and Tanjore, and the chief problem would therefore appear to be to try and maintain the present rice trade from Tanjore rather than to extend it.

That Tanjore rice sells at Rs. 3 more per bag than Burma rice is due to several causes viz., (1) the comparatively higher cost of production in Tanjore, (2) the greater transport charges by rail from Tanjore to Ceylon, and (3) bigger profits made by the Tanjore rice merchants. As regards the first point the only possible way of reducing the cost of production in Tanjore would appear to be to increase the acre yields by growers adopting more intensified methods of growing the crop on the lines advocated by the Agricultural Department.

About the second point, which is probably the most important of the three, the attempt should be to try and get the South Indian Railway Company to reduce their transport charges which are at present too high, even higher than the rates charged by the sister company, the M. S. M. Railway Company. It is found cheaper to transport rice by rail from Cocanada to Calicut, a distance of 815 miles than from Kuttalam to Calicut a distance of only 654 miles. The Tanjore District has a number of coastal ports and all the rice trade with Ceylon was being transacted through these in earlier years. The S. I R. Company has been responsible for the closure of these ports by its allowing special reduced rates from places on the line near to these ports. If the trade through these ports could be revived, it would appear that there will be a saving of Rs. 5-8-0 per ton of rice in the transport charges. Even if the company cannot reduce their rates sufficiently to cover the entire difference between the selling prices of Burma and Tanjore rices in Ceylon, any small reduction would be a welcome relief to the Tanjore trade. This reduction will not only enable rice growers of Tanjore to maintain their present trade with Ceylon but also successfully to compete with the rice growers of Kistna and Godavari deltas who are now able to sell their rices cheaper in Malabar and in the other Tamil Districts, due chiefly to the lower rates charged by M. S. M. Railway Company.

Lastly, the Tanjore merchants are already making a bigger profit in their business than the Burma merchants and reduction in rail freights may only increase the profits of these merchants and not bring the desired relief to the rice growers. To counteract this, the report suggests that the rice growers in Tanjore should themselves organise co-operative selling societies and dispense with the intermediary merchants.

Another useful suggestion given in the report is that Tanjore must export to Ceylon coarser varieties of rice than *Sirumani* like *Kattaisambala* which would compare favourably with the best Burma rice This variety is generally a much heavier yielder than *Sirumani* and with a possible slight reduction in railway freight, Tanjore growers would be able to sell this rice in Ceylon at the same price as the Burma rice.

In this connection attention may be drawn to the fact that there is a very big trade in raw rice in Madras and in other South Indian towns. The variety known as Nellore rice finds a ready sale at these places and the whole quantity of it is imported from Kistna. The same variety of rice, *Nellore samba*, is grown in large areas in Tanjore District also and no serious attempt has ever been made by the Tanjore people to prepare raw rice from this variety in the district and cater to the needs of these towns. Of a quarter of the total production in the district which is available for export only 40% goes to Ceylon and the district has to find suitable markets for the remaining 60%. It is the successful solution of the latter question that is likely to bring about substantial relief from the present slump. (K. R.)

Crop & Trade Reports.

Sugar refined from Gur in India, 1931.

There are at present 33 concerns in India equipped for refining *gur* or raw sugar, out of which 19 factories also manufacture sugar direct from cane and 14 work with raw sugar alone. Of the former only 3 refined *gur* during the year 1931 and of the latter 7 worked during the year, 4 were silent and returns from 3 have not been received. There were thus 10 factories refining *gur* as against 11 factories during the year 1930. Of the 10 factories that refined *gur* during the year 1931, 6 are situated in the United Provinces, 3 in Madras and 1 in the Punjab.

The figures of *gur* or raw sugar melted, sugar manufactured and molasses obtained in the whole of India during the year 1931 are given below. The figures for the concerns in the United Provinces and the Punjab are also given separately.

Total for the United Provinces.

		1931	1930
Gur or raw sugar melted	...	925,610 mds.	594,735 mds.
Sugar manufactured	...	471,737	311,931
Molasses obtained	...	363,413	222,635

Total for Madras and Punjab.

Gur or raw sugar melted	...	646,015	425,368
Sugar manufactured	...	393,627	263,778
Molasses obtained	...	193,458	128,488

Grand total for India.

Gur or raw sugar melted	...	1,571,625	1,020,103
Sugar manufactured	...	865,364	575,709
Molasses obtained	...	556,871	351,123

A note published in the Indian Trade Journal, dated the 27th August, 1931, gives the total quantity of sugar produced by factories making sugar direct from cane for the two years 1930—31 and 1929—30 as follows :—

1930—31. ... ... 3,262,574 mds., or 119,859 tons.
1929—30. .. ... 2,443,486 ,, or 89,768 ,,

If the quantity of sugar refined from *gur* or raw sugar in India by modern process during these two seasons be added to the above figures the total production in the combined seasons will amount to 4,127,938 mds. or 151,650 tons in 1930—31 as compared with 3,019,195 mds. or 110,918 tons in 1929—30. (R. C. Srivastava in *Agriculture and Livestock in India*, Sepr., 1932).

Paddy crop of Madras—1932-33—Second Report.

On an average of the five years ending 1930-31, the area under paddy in the Madras Presidency has represented 13·3 per cent of the total area under paddy in India. The figures in this report relate to the paddy crop sown between February and November 1932. (Estimates up to 25th November 1932). The area sown with paddy is estimated at 10,312,000 acres against 10,360,000 acres for the corresponding period of last year, i. e., a decrease of about 0·5 per cent. There has been a reduction in area in Ganjam, Vizagapatam. Cuddapah, Nellore, Chingleput, Chittoor, and North Arcot and partly set off by an increase in most of the other districts. The first crop has been harvested throughout the Presidency. Normal yields have been reported from all districts except Vizagapatam, Godavari (East and West), Chittoor and North Arcot. The crop was affected to some extent by insects and fungoid pests in parts of Godavari (East and West), by drought in Vizagapatam and by late planting in Chittoor and North Arcot. The seasonal factor for the Presidency works out at 99 per cent of the average against 98 per cent for the corresponding period of the previous year. The wholesale price of paddy per rupee is reported as 57 lb. in Tanjore, 29 lb. in the Deccan and 36 to 40 lb. in other districts. (*From the Board of Revenue, Madras*).

Cotton crop of Madras 1932-1933 (Third Report).

Note:— On an average of the five years ending 1930-31, the area under cotton in the Madras Presidency has represented 8·9 per cent of the total area under cotton in India. The figures in this forecast relate to the cotton crop sown between April and November 1932. (Estimates up to 25th November 1932). The area sown with cotton is estimated at 1,727,600 acres as against 1,777,500 acres for the corresponding period of last year. There has been a reduction of 2·8 per cent. There has been a marked fall in area in the Deccan (-204,000 acres). This is due partly to want of timely rains and partly to the preference given to groundnut and cholam in parts. The area under irrigated cotton, mainly Cambodia, is estimated at 156,300 acres against 117,000 acres last year, an increase of about 34 per cent. Pickings of the early sown crop in the Deccan are in progress and the yield is below normal owing to drought at the beginning. The condition of the main crop throughout the Presidency is satisfactory. But in parts of Tinnevelly, the young plants were reported to have been destroyed by stemweevils and the crop had to be resown. The seasonal factor for the Presidency works out to 99 per cent of the average against 100 per cent in last year. On this basis, the total yield is estimated at 361,300 bales of 400 lb. lint against 342,100 bales of last year, an increase of 5·6 per cent. The crop is young and it is too early to estimate the yield with any degree of accuracy. The local cotton trade is not active at this time of year. The wholesale price of cotton lint per bale of 400 lb. does not show much variation as compared with the prices prevailing in the previous month though the price of Cambodia shows a slight rise. The present prices are reported to vary from Rs. 85 to Rs. 90 for *mungari* (early crop) westerns, Rs. 88 to 92 for Northerns, Rs. 120 for Cambodia, Rs. 104 for Tinnevelly and Rs. 108 to 116 for Karunganni cotton. (*From the Board of Revenue, Madras*).

Castor Crop Report for Madras 1932. First or Final Report.

(On an average of the five years ending 1930—31, the area under castor in the Madras Presidency has represented 23·1 per cent of the total area under castor in India. The figures in this report relate to the castor crop sown between December 1931 and November 1932.) (Estimates up to the 25th November 1932.) The area under castor in the Madras Presidency is estimated at 333,600 acres as compared with 324,300 acres, estimated for the same period last year, or an increase of 2·9 per cent. The estimate for last year fell short of the actual area of 330,106 acres by 1·8 per cent.

The increase is general outside Ganjam, Vizagapatam, West Godavari, the Deccan (Anantapur excepted) and South Arcot. The yield is expected to be normal against 97 per cent in the previous year according to the season and crop report. On this basis, the yield is estimated at 34,700 tons as against 32,400 tons estimated for the corresponding period of last year, and 32,970 tons estimated in the season and crop report of last year.

The wholesale price for castor seed ranges generally from 23 to 24 lb. per rupee in Trichinopoly and the Deccan (Cuddapah excepted) and from 16 to 20 lb. in the other districts. As compared with December 1931, the price has been more or less stationary in Kistna, Guntur, Nellore, Chittoor, North Arcot and Madura, has risen in Salem and fallen in the other districts. (*From the Board of Revenue, Madras*).

Gingelly Crop of 1932—33—First Forecast Report.

(*Madras Presidency.*)

On an average of the five years ending 1930—31, the area under gingelly in the Madras Presidency has represented 12·5 per cent of the total area under gingelly in India. The area sown with gingelly up to the end of July 1932 is estimated at 388,800 acres as against 332,100 acres during the corresponding period of last year. There has been an increase of 17 per cent. The increase in area is general in all important districts except Vizagapatam.

2. The yield is expected to be normal except in Ganjam, Vizagapatam Bellary, Anantapur and Chingleput where the crop was affected by drought, to some extent. 3. The wholesale price of gingelly is reported as 9 to 10¼ lb. per rupee in Ganjam, Chingleput, South Arcot, Chittoor, North Arcot, Salem and Tanjore; 14 lb. in Anantapur, and 11 to 13 in other districts. As compared with the prices reported in April 1932, the price was stationary in Vizagapatam, Kurnool, Chittoor, North Arcot. Coimbatore, and Tanjore; cheaper in South Arcot, Salem, Trichinopoly, Madura, Tinnevelly, and Malabar; and dearer in the other districts. (*From the Director of Agriculture, Madras*).

Groundnut Crop, 1932–Second Forecast Report. (*Madras Presidency.*)

The area sown with the summer of irrigated crop of groundnut in parts of the Madras Presidency during the five months January to May 1932 is estimated at 67,700 acres. The condition of the crop is satisfactory and harvest of the crop is proceeding in South Arcot. The total yield is estimated at 60,400 tons of unshelled nuts. 2. The early crop of groundnut (most unirrigated) sown up to the end of July 1932 in the districts of Salem and Coimbatore is estimated at 159,000 acres against 120,000 acres during the corresponding period of last year. The increase is due to timely sowing rains. Condition of the crop is good. The total yield is estimated at 79,500 tons of unshelled nuts against 57,000 tons during the corresponding period of last year. (*From the Director of Agriculture, Madras*).

Pepper Crop of 1932–33–First Forecast Report. (*Madras Presidency.*)

The area planted with pepper up to the end of August 1932 in the districts of Malabar and South Kanara is estimated at 87,300 acres (80,000 acres in Malabar and 7,300 acres in South Kanara) against 90,943 acres (83,409 acres in Malabar and 7,534 acres in South Kanara) in the previous year. The condition of the crop is fairly satisfactory. 2. The present price of pepper is Rs. 160 per candy of 500 lb. (*From the Director of Agriculture, Madras*).

First Forecast Report on Ginger—1932–33. (*Madras Presidency*)

The area planted with ginger up to the end of August 1932 in Malabar is estimated at 10,000 acres against 10,635 acres in 1931—32. The condition of the crop is fairly satisfactory. (*From the Director of Agriculture, Madras*).

Association of Economic Biologists.

Under the auspices of the association there were two public lectures delivered by two of the Officers of the Bombay Department of Agriculture who had come on a visit to Coimbatore.

The first one was by Rao Sahib B. P Vagholkar, Special Sugarcane Research Officer, on 10th November, the subject of the lecture being 'Agricultural improvements in the famine areas of the Bombay Presidency'. The lecturer first described the general conditions obtaining in the tract. The annual rainfall was generally scanty, under 20 inches, and that badly distributed. The soils were very light and shallow and mostly undulating. They do not have more than three good seasons in a cycle of twelve years and the average outturn of these areas was only a six-anna crop.

The improvements successfully introduced by the Department were (1) the use of iron ploughs, (2) bunding of the fields to prevent soil erosion, (3) sieving of the *jowar* (sorghum) seeds used for sowing purposes, and (4) the profitable dry farming practices as deep tillage, sowing the crop wider apart, frequent interculturing etc. Though the introduction of iron ploughs was very difficult in the beginning the practice has now become so common that in two of the districts in this area there are now over 50,000 ploughs in actual use.

As regards the bunding of the fields, before the practice could be introduced, a great deal of attention had to be paid to the study of the topography of the tract, the amount and distribution of the annual rainfall etc., so that the Department could recommend the most efficient type of bund to be used for particular areas. There were three types of bunds used costing respectively Rs. 10, 50, and 300 per acre. The average yields of the bunded fields soon began to rise and the increases over the unbunded fields were often 50 to 150 per cent. The sieving of the jowar seed has been found to be very profitable and increased yields of 30 to 50 per cent have often been obtained even with this one improved practice.

The lecturer then gave an interesting account of the attempts made by the Department to form rural co-operative societies for the benefit of the people in the tract. About the possibilities of this line of work, the example of an implement society with 700 members spread over 90 villages, and which with a capital of Rs. 8000, had made a profit of Rs. 5300 within six years by the hiring of implements, was cited. He also mentioned the possibilities of making use of the rural school teachers in helping the Department in its propaganda.

On the 21st December Mr. B. S. Kadam, Crop Botanist, gave his lecture on 'Crop improvement work in the Bombay Presidency'. The lecture was very informative on the breeding and selection work being done by the Bombay Department in the various food and industrial crops. Because of the varying climatic conditions obtaining in the different parts of the province, each tract has its own special set of varieties and the breeding work to be most successful has to be carried on at more than one centre for each of the crops handled. For *Jowar*, (sorghum) the most important food crop, work was first started at two centres, Sholapur and Satara, and this has now been extended to a third centre, Dharwar. In the *jowar* crop mere sieving of the seeds has always given an increased yield and the lecturer stated that a botanical explanation for this behaviour had recently been found. The *jowar* consisted of two types, one a fast-growing and the other a slow-growing one. The latter always suffers for want of moisture in the soil just when the grain is ripening and consequently it becomes small and shrivelled up. The sieving eliminates the poor developed grains and the sieved grains gives a crop consisting entirely of the quick growing type which with the available moisture in the soil gives better out-turns.

Work on wheat, the next important cereal grown largely in the Deccan, had been going on for over twelve years. The crop once in 3 or 4 years was subject to the attack of black rust resulting in heavy losses. By breeding and selection the Department has been able to produce two strains which were very satisfactory.

Rice, the important crop of the Konkan tract has also been tackled and several improved strains have been evolved and distributed to the people. Strain 'kolamba 79' was one of the best, a rapidly maturing, fine rice. As regards tobacco which is also one of the crops under investigation, the attempt has been to evolve a mild type suitable for cigarette manufacture, Type No. 45 which they have already got appears to be suitable for the purpose. With regard to cotton, Bombay has concentrated areas under different types of cotton and breeding work in this crop has been going on since 1899. There is a special officer in charge of this work for each of these tracts and a number of strains have been evolved suitable for the different tracts which easily give increased out-turns of 10—15 °/o over the local varieties. In Guzaret and Kandesh the chief trouble with this crop was the wilt problem and work was in progress to evolve wilt resistant forms. Besides the above mentioned crops the Department, the lecturer stated, was carrying on work in castor, ragi, chillies and brinjals. (K. R.)

College News and Notes.

The College reopened after the Christmas and New Year holidays on the 4th. January. On the same day evening, the students of II B. Sc. class started on an agricultural tour of the ceded districts and came back on the 14th.

Rao Bahadur C. Tadulingam. There was general satisfaction on the colony on the receipt of the news that the title of Rao Bahadur was conferred on Mr. C. Tadulingam, our Principal. The Rao Bahadur was the recipient of several congratulatory messages from far and near and was entertained at several parties held in his honour both in the colony and in Coimbatore town.

Radhakalyanam. The annual observance of *Danur masa pooja* was held this year also on the estate and culminated in the celebration of *Rhada Kalyanam* on Sunday the 8th January with the usual festive pomp. The estate Boy Scouts rendered very good service on the occasion by erecting a pandal with raw materials, supplied to them

Ladies' Club. After five years of gradual growth, the Agricultural College Ladies' Club has ventured on putting up a habitation for themselves. The construction of a club building has begun in right earnest on a plot of land one acre in extent which was kindly leased out by Government for the use of the club.

District Agricultural Conference. A Conference of the Agricultural Officers of the Coimbatore District was held at Coimbatore on the 9th and 10th January and was presided over by Rao Bahadur D. Ananda Rao Garu, the Headquarters Deputy Director of Agriculture.

Games. Cricket Tour. After breaking the ice with a tour to Palghaut, the College cricket team ventured out to Tellicherry and played two matches there towards the end of November. The first match was against the Brennen College whom they met within a couple of hours of their arrival at Tellicherry. For the first time during the season our colours were lowered, our opponents giving us a heavy defeat. Winning the toss our team elected to bat on what later proved to be a treacherous wicket. There was a series of batting failures, two run outs and two l. b. w. s. aggravating our misfortune. Our total was only 35 runs of whinh Murti contributed 10 runs. Our opponents passed our total for the fall of only 2 wickets and went on merrily till they topped 140 for 3 wickets and put us in again. Our opening batsmen made 20 runs when a sharp shower fell which prevented further play for the day. Ananda showed a spark of his usnal self in scoring four boundaries in quick succession.

The next day we were pitted against the Tellicherry town club a strong local combination which included the pick of the College team. Despite the injury which our wicket keeper sustained the previous day, our team contrary to expectations gave a very good account of themselves. The club was dismissed for 89 runs Varadarajan, taking 5 wickets for 23 runs, Narayanan 2 for 15 and Lakshmanan 3 for 45· Though we opened disastrously and lost 4 wickets before the second decade was registered, thanks to an excellent winnings played by Narayanan and an invaluable defence put up by Ramanatha Rao, we passed our opponents' total with 4 wickets and finished up with 101 runs. Narayanan made 52, Ramanatha Rao 12 and Suryanarayanamurti 16. That cricket is a great game of glorious uncertainties was again proved by our defeat by the College team and our creditable win over an exceedingly strong combination.

Agricultural Student for 'Varsity team. For the second year in succession one of our College students gained a place in the 'Varsity cricket team. It will be recalled that U. Patraik played for Madras against Aligarh last year and turned-out to be the hero of the match. This year K. M. Narayanan of B. Sc. III was selected and was the recipient of the 'Varsity colours He toured with the team to North India and playing against Delhi and Aligarh rendered a good account of himself. It may be mentioned to his credit that he was one of the two Moffusilites selected for the cricket team after undergoing the strenuous tests made by "Bill" Hitch and Prof. C. K. Krishnaswami Pillai at Madras.

Officers' Club. At a general body meeting of the club held on the 16th Rao Bahadur C. Tadulingam, Mr. N. L. Dutt and Mr. V. T. Subbiah Mudaliar were elected President, Vice President and Secretary respectively.

Indian Officers' Association. At a meeting of the Indian Officers' Association (Agricultural Branch) Rao Bahadur T. S. Venkatraman, Mr. G. N. Rangaswami Ayyangar and Mr. K. M. Thomas were elected President, Vice President and Secretary respectively.

Association of Economic Biologists. At the annual inaugural meeting of the Association Mr. S. Sundara Raman, Government Mycologist, gave a lecture on Professor of Mycoloigcal Research in Madras,

Departmental Notifications.

I Circle. G. Ranganadhaswamy, F. M. Samalkota, l. a. p. for 20 days from 30—11—32 to 19—12—32 both days inclusive. A. Rammohan Rao, A. D. Rajahmundry, l. a. p. on M. C. for 2 months from 21—11—32. D. Hanumantha Rao, A. D. Razole, l. a. p. for 15 days from 9th to 23rd December 1932, suffixing christmas holidays. T. Rangabrahma Rao, F. M. l. a. p. for 3 days from 3rd to 5th January '33 in continuation of Xmas holidays. **II Circle.** D. Panakala Rao, A. D. Gurzala, l. a. p. for one month and 15 days from 3—1—33 with permission to avail of the christmas holidays. **III Circle.** *Transfers.* M. Jeevan Rao, F. M. Hagari, to be A. D. Giddalore. Gulam Ahmad, A. D. Giddalore to be F. M. Hagari. K. V. Seshagiri Rao, transferred from the II circle, to be A. D. Allagadda. K. Hanumantha Rao, A. A. D. Rajampet, l. a. p. for 10 days from 3—1—33 with permission to prefix the christmas and New year holidays. K. Rama Rao, A. D. Cuddapah, will be in additional charge of Rajampet sub circle. **IV Circle.** K. Varadhachari, F. M. Palur, under going training in ericulture at Madras, l. a p. for 11 days from 1—12—32 to 11—12—32 **VII Circle.** E. Achuthan Nair, l. a. p. for 2 days on 20th and 21st December 1932 P. Abdulla Haji, A. D. Manantoddy, l. a. p. for 17 days from 15th to 31st January, 1933 both days inclusive. **VIII Circle.** C. S. Namasivayam Pillai, A. A. D. Omalur, l. a. p. for 6 days from 5—12—32 with permission to avail the Sunday on the 4th and 11th December 1932, B. Dasappa Malli, A. D. Coonoor, l. a. p. for 21 days, from 3—1—33 to 23—1—33 with permission to prefix christmas and New year holidays. **O. S. S's Section.** T. Gopalan Nair, F. M. Nileshwar, l. a. p. for 9 days from 3rd to 11th January 1933, with permission to avail the Christmas and New year holidays and on 12th and 13th, Jannary 1933. A. P. Balakrishnan Nair, F. M. Pilicode, l. a. p for three days on 20th, 21st and 22nd December 1932 with permission to avail the christmas and New year holidays. **Paddy Section.** M. Narasimham, Asst. l. a. p. for one month from 3—1—33 to prefix christmas holidays **C. S's. Section.** P. Abraham, Asst. l. a. p. for 11 days from 12—12—32 to 22—12—32 with permission to prefix Sunday 11—12—32 and to affix the Christmas and New year holidays. **G. A. C's. Section.** T. Varahalu, Chemical Assistant, Anakapalle, l. a. p. for 11 days from 5—12—32. **Principal's Office.** S. R. Srinivasa Iyangar, Librarian, l. a. p. for 4 days from 3—1—33 with permission to avail of the holidays on the 7th and 8th instant. **D. A's. Office Orders.** A. Chinnathambi Pillai, A. D. on return from leave is posted as F. M. Palur. K. Ramanuja Acharya, F. M. Kalahasti on the expiry of his leave on the 23rd January, to Guntur to be in charge of both the Livestock Research Station and the Agricultural Research Station. Bhagirathi Padhy, A. D. Nandyal, on the expiry of his leave on the 22nd December 1932, to I circle to be employed in Ganjam or Vizagapatam Districts. K. V. Seshagiri Rao, A. A. D. Vinukonda, to III circle. K. Brahmachari, Entomology Assistant, extension of l. a. p. for 24 days from 23—12—32.

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THE RELATION OF SIZE & SHAPE OF PLANT TO THE YIELD OF COTTON

By S N. VENKATRAMAN, B.A., B.Sc. (Ag.) & C. JAGANATHA RAO, B.A.,

Assistants to the Cotton Specialist.

The relation of branching habit to economic characters in Cotton has been the subject of study by many workers. Prominent among characters investigated in this connection are earliness (Leake 1914), shedding (Cook 1911, Harland 1917) and yield per plant (Burt 1919, Cook 1911, Patel 1921 and Kottur 1920). Besides such economic relationships, the genetic behaviour has also been studied. The habit of the plant and the production of basal monopodia have been found more or less, heritable in a number of American and Indian types as the Cawnpores (Leake 1914), Kumptas (Kottur 1920) Gujerats (Patel 1921), Cawnpore-Americans (Burt 1919) and Americans. There is however evidence from other sources to show that considerable environmental modification occurs (Hudson 1920) which can even have large economic significances (Cook 1911). Of particular interest in plant breeding is the evolution of special types associated with good yields. Many workers (Cook, Leake, Kottur loc. cit.) prefer a purely sympodial habit in the plants as more of these could be grown per acre to give higher yields. It should however be mentioned that part of the above behaviour is dependent on the variety of cotton examined. The results of such a study on a type of *G. indicum*, which, along with a variable mixture of *G. herbaceum*, forms the commercial "Northerns" crop of this Presidency is presented in this paper.

Material and Methods. The plants examined comprised the progeny of forty six single plant cultures grown in the Nandyal Agricultural Research station during the year 1931–32. Altogether 5970 single plants spaced three feet by two feet, were examined. Of these 3,880 plants were attacked by the shoot borer (*Earias sp.*) but these were also included to investigate the part played by this insect in the yield of the plant. To ensure uniformity in all strains, border plants were excluded for a distance of ten feet at the ends. The characters taken up for study were as follows:—

(1) Height of plant.
(2) Number of nodes per plant.
and (3) Number of bearing monopodia per plant.

Very small or poorly developed monopodia were not included in the counts. On the basis of these three characters, which essentially determine the plant configuration for this species of Cotton, the relation of yield (kapas per plant) were investigated. For purposes of comparison, similar data on a species of *G. herbaceum* forming the *Uppam* Cotton of the Presidency and grown in the Coimbatore Cotton Breeding Station during the years 1925–27 are also included in places.

The correlation of yield to other characters. Taking into consideration each of the forty six cultures separately, the coefficient of correlation of yield with height nodes and monopodia were determind. The frequencies of these correlation coefficients are given in Fig. I. for bored and normal plants respectively.

An examination of figure I shows that the correlations are generally higher in the normal plants than in the bored ones. This difference was found significant in all cases. (Student's method. Fisher 1932). The values of these mean correlation coefficients are given in Table I.

TABLE I. **Correlation of yield of the plant with other characters within the same strain**:—

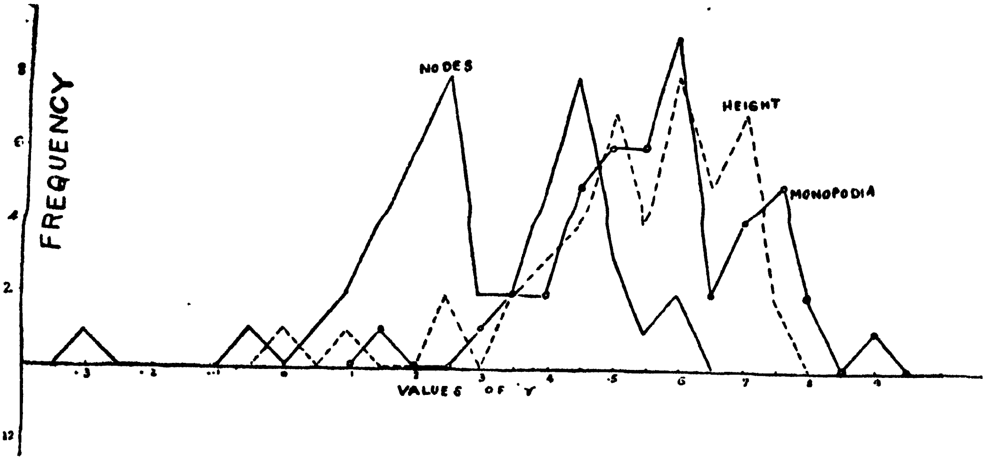
(Mean value of '*r*' (forty-six strains)

Relative.	Subject, (1) yield of plant (Kapas weight)	
	In bored plants.	In normal plants.
2. Number of monopodia.	0·483 ± 0·013	0·571 ± 0·015
3. Height of plant.	0·251 ± 0·012	0·532 ± 0 016
4. Number of nodes.	0·129 ± 0·014	0·301 ± 0·016

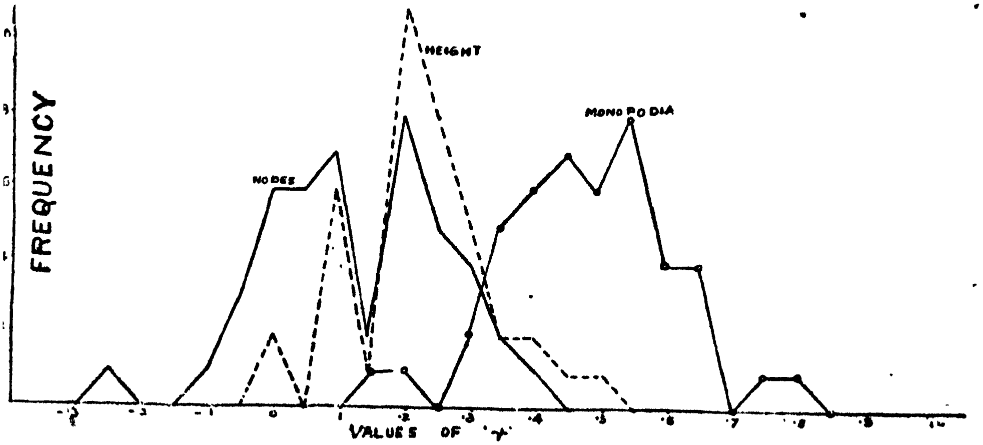
Fig. I.

FREQUENCIES OF CORRELATIONS OF YIELD WITH OTHER CHARACTERS

Normal Plants.



Bored Plants.



It will be seen that the coefficients are all significant. An examination of Figure I shows that in normal plants the monopodia ($r =$ ·571±·015) and height of plant ($r =$ 0·532±·016) are markedly related to the yield, while the relation of number of nodes although significant is variable. In bored plants however, the relation of monopodia ($r =$ ·483±·013) is much greater than that of height of plant ($r =$ 0·251 ±·012) while the effect of number of nodes is again small. These relations refer to variations from plant to plant within the same strain as determined by environmental influences, but what is of more interest in genetic studies is the behaviour from strain to strain i. e., the part played by the different characters in determining the yield from one selection to another.

Relation of characters from strain to strain. For the above purpose, the mean values of the forty six selections for the different characters were correlated with the corresponding mean yield. The resulting coefficients are given below.

TABLE II. **Correlation coefficients of yield of strain with other characters**

	Subject. Yield of strain (1)		Partial correlation Coefficients.	
	Bored.	Normal	Bored.	Normal.
2. Number of monopodia.	0·598±0·064	0·648±0·058	r 12·3 = 0·532±·071	0·637± .059.
3. Height of strain.	0·324±0·088	0·175±0·096	r 13·2 = ·034±·100	0·081± .099
4. Number of nodes.	0·220±0·095	0·075±0·100		

It will be seen that the number of monopodia is the only character on which the correlations can be held significant. The partial coefficients indicate that the height of strain is of little importance. It would appear therefore that selection for yield on a height basis will not be lasting in the succeeding generations, but selection of monopodial types will be of more permanent value. To investigate these relationships more fully, it will be necessary to know how changes in yield are associated with changes in the other characters.

Regression on characters of the yield of the plant : In finding this relation of yield to other characters, all the 5970 plants were grouped together into two categories as bored and not bored, and the regressions of yield determined on each character. The curves representing these relationships are given in Figures II, III and IV.

An examination of Figure II will show that in the case of monopodia, the regressions are rectilinear and similar for bored and normal plants. This shows a more or less, proportionate increase in yield with increase of monopodia.

Figure II. As regards height, the relation is rectilinear for normal plants and very nearly so for a considerable height in bored ones.

Figure III. In the case of number of nodes the relationship is definitely more complex than in the two other characters, and very dissimilar in bored and normal plants.

Figure IV. Judged by the pronounced curvilinear regression of the character, and taking into account, the small values of its correlation coefficients, the number of nodes does not appear to be a factor on the basis of which selection for yield will be profitable. Greater significance attaches to the relation of height of plant and monopodia, where the relationship is rectilinear. Of these two characters, the influence of height has been shown to be purely environmental. As the effect of monopodia is both environmental as well as genetic, it is obvious that it deserves greater attention in the choice of high yielders.

The effect of the borer (*Earias sp.*) on the yield of the plant:— A point of interest in these studies is the part played by the borer in the yield of the plant. The attack of the borer in the present case is so high as 65%. Considering the pronounced modifications it introduces in the plant scaffolding the effect requires fuller study. An examination of the yield of bored and normal plants in the forty-six selections shows that the attacked plants have given a significantly higher yield than the others. Table III (a).

TABLE III (a). **Mean difference between bored and normal plants.**

Variety.	Character.	Difference Bored—Not bored.	S. E. of difference
G. indicum.	Yield (ounces per plant.)	0·2204.	·0144 oz.
Northerns.	Number of monopodia per plant.	0·609.	0·079.
	Rate of increase of yield per monopodium	0·025.	0·008 oz.

An examination of Table III shows that the increased yield is brought about in two ways. Firstly, there is an increased production of monopodia. Secondly, there is an increased productivity per monopodium. (Figure II). The rate at which yield increases with increase of monopodia is greater in the bored plants (Fisher. Page 123).

An examination of the standard errors given in Table III (a) shows that the differences are significant in both of these cases.

It should be mentioned that the increased yield due to borer attack is opposed to the findings from other species of Cotton as *G. hirsutum* (Cambodia—Ramanathan 1931) or *G. herbaceum* (Uppam). Table III (b) below.

Fig. II.

REGRESSION OF YIELD ON MONOPODIA

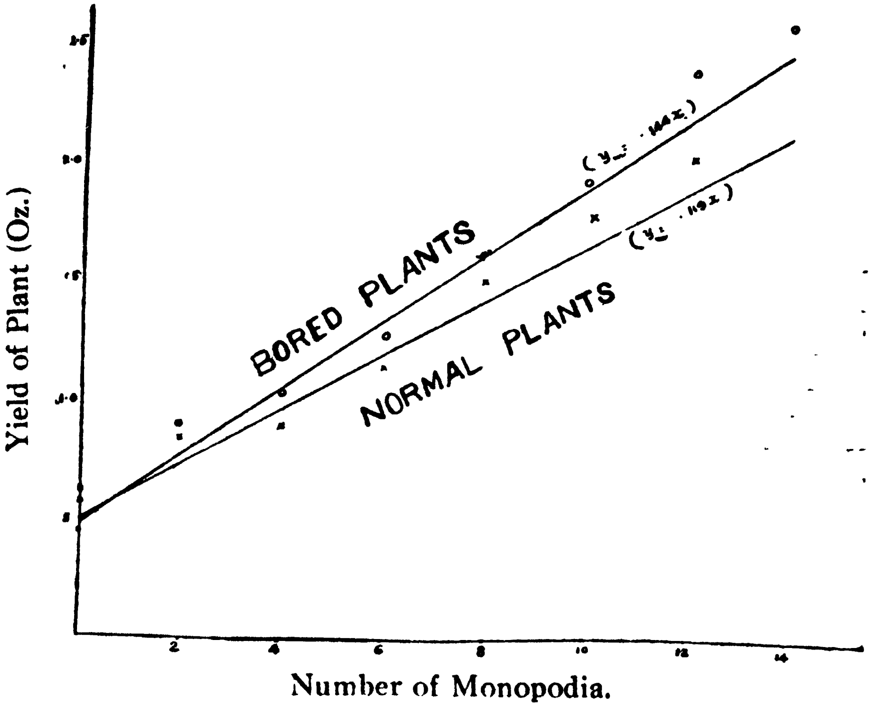


Fig. III.

REGRESSION OF YIELD ON HEIGHT OF PLANT

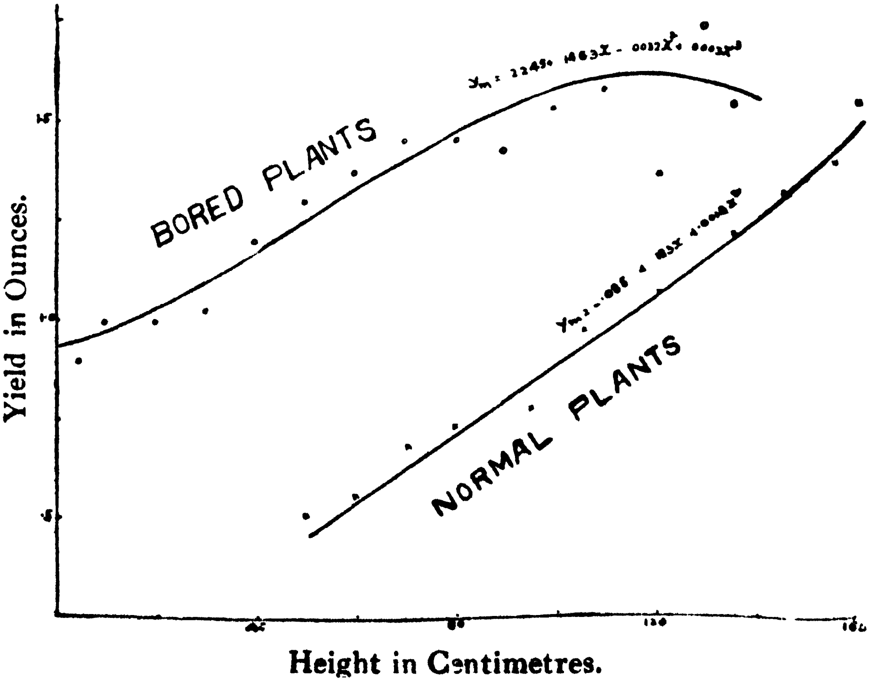


Fig. IV.

REGRESSION OF YIELD ON NUMBER OF NODES

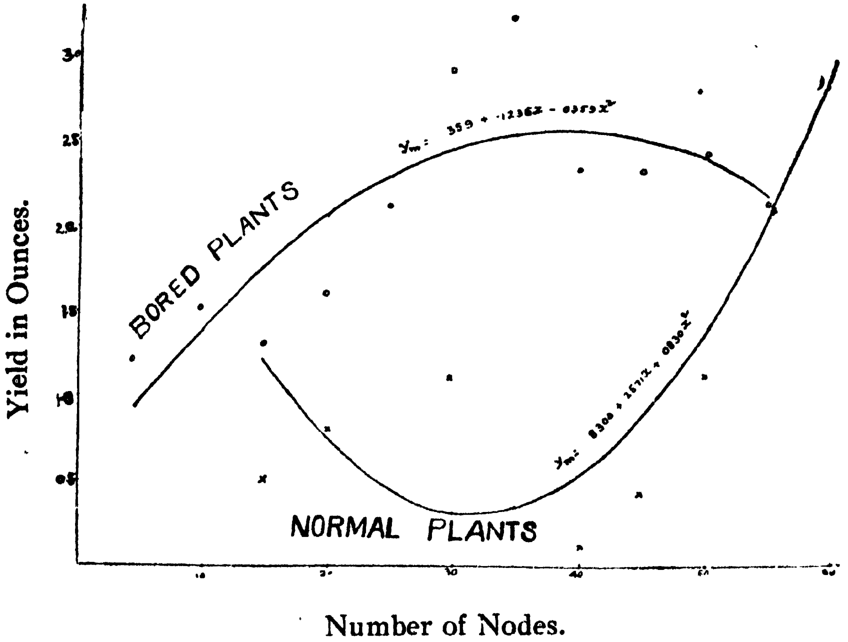


Fig. V.

REGRESSION OF MONOPODIA ON HEIGHT

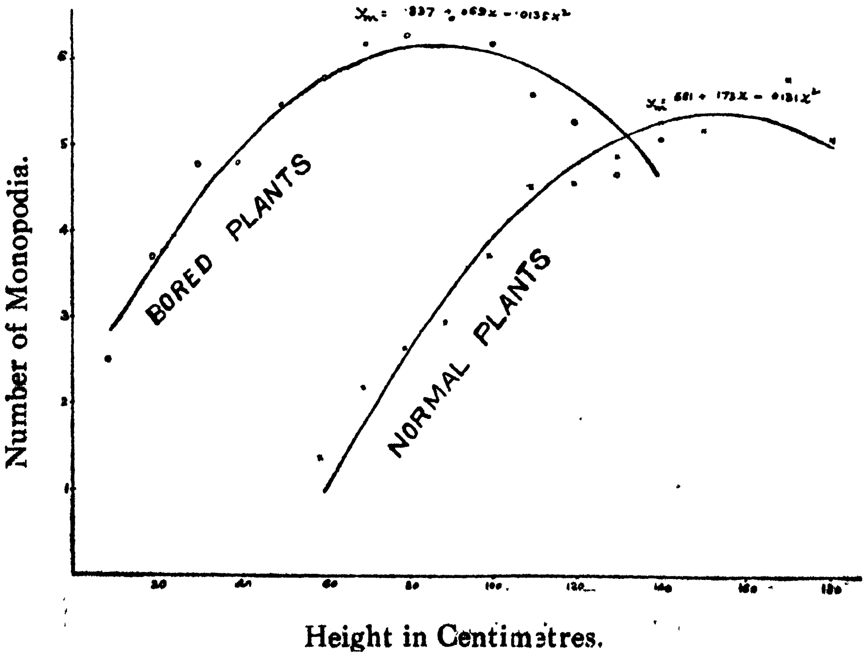


TABLE III (b). **Mean difference in yield between bored and normal plants in G. herbaceum (Uppam).**

Strain No.	Year.	Number of bolls per plant.		Difference in favour of normal plants.
		Mean of bored plants.	Mean of normal plants.	
54	1924—25	50·76	55·20	4·44
	1925—26	32·22	50·13	17·91
	1926—27	19·42	33·14	13·72
615	1924—25	33·51	37·57	4·06
	1925—26	36·19	48·09	11·90
	1926—27	25·11	27·05	1·94
1885	1924—25	31·75	32·70	0·95
	1925—26	25·76	33·62	7·85
	1926—27	30·25	27·75	2·50
2405	1924—25	30·07	27·12	2·95
	1925—26	42·24	48·76	6·52
	1926 27	28·14	28·47	·33
146	1924—25	29·07	27·62	1·45
	1925—26	33·89	44·38	10·49
	1926—27	25·57	30·42	4·85
480	1924—25	17·38	24·66	7·28
	1925—26	34·04	41·43	7·39

It is probable that the difference in behaviour between the 'Northerns' Cotton and the other two is due to the very high monopodial nature of the former type. Whereas in Cambodia the first sympodial node occurs within a range of five to ten nodes, and in 'Uppam' within seven to twelve, the range in Nandyal Cottons varies so high as thirteen to twenty-two. As such there is a greater chance for more monopodia to develop from the attack.

This effect of the borer appears also to be decided by the time at which the attack occurs. For instance, a well defined relationship is indicated between the growth stage of the plant at boring and the response in yield. An examination of Figure II shows that the higher on the plant the attack the greater is the yield, and to a large extent the production of monopodia (Figure V.)

Figure V. Although the above relationship of height and monopodia persists even from one strain to another, (r.23 = 0·501 ± 0.074) it is not the case between height and yield (r.13 = 0·324 ± ·038 r.13.2 = .034 ± .100). The conclusion is probable from this that the quicker growing plants in a strain are likely to benefit more by attack, while this is not necessarily true of more quickly growing strains in a group of selections. In other words, the yield relationship is more or less environmental. A practical application of this will be that forcing the growth, by manuring for instance, and topping the plants will

induce higher yields in this type. Experiments are now being undertaken to test this point.

Discussion. It will be interesting to compare the above results with the findings of other workers. In Goghari Cotton (*G. herbaceum*) Patel (1921, 1924) prefers a tall strain with open habit and large number of vegetative branches, but in another variety of the same species (Kumptas) Kottur finds the reverse to be the case (8). The relation of monopodia to yield is not so pronounced in other species of cotton as for Northerns. In American cottons (U. S. A. Dept. Bull. 169) positive correlations between these characters ranging from 0·029 to 0·435 were got, while it was concluded that the isolation of a strain producing few basal limbs would not influence its productiveness. Burt (1919) prefers a compact type with a limited number of monopodia in Cawnpore-American cottons. In the Uppam cotton plant (*G. herbaceum*) the relation of yield and basal limbs is small ($r = 0.290 \pm .019$) although significant. It should however be recalled that some of these are sympodial types where the change from basal limbs to fruiting branches occurs early and is usually abrupt. In "Northerns" cotton however the production of monopodia is more continuous and the differences in behaviour can be attributed, as before, to this monopodial habit.

A problem of very common interest amongst cotton workers is the isolation of branching types adaptable to high acre yields. Although individually less productive, a sympodial type of plant is preferred in many species as the greater number of plants per acre more than make up for this deficiency. (Cook, Leake, Kottur loc cit). This type is early (Cook 1911) and has been found to produce bigger bolls in Kumpta cotton. (Kottur 1920). On the other hand it has been shown that in the species of Northerns cotton investigated, environmental and genetic conditions which favour the production of monopodia are also conducive to good yields. This is also true of Gujarat cotton (Patel 1921, 1924). As however the height of the strain by itself has no particular significance to the yield, it does not seem desirable to bestow too much attention to the selection of taller types. The indications are towards selection of medium sized compact types with moderate production of monopodia, as these will have the advantage of more plants per acre preferred by other workers. Observations have shown that the differential tendency of types to produce monopodia persists also in bulk plants, although it is not so pronounced as in the wider spaced single plants examined for this study. Selection on the basis of monopodia is therefore justifiable in "Northerns" (*G. indicum*) cotton.

Summary. The relation of height, nodes and number of monopodia to the yield of cotton was investigated in 6000 plants, being the

progeny of forty six selections of Northerns cotton. (*G. indicum*) grown at Nandyal.

It was found that in plants of the same strain, the number of monopodia and height of plant were markedly correlated with yield. The genetic relation from strain to strain was however different. While taller types were not necessarily good yielders, strains with more monopodia were more productive. The number of nodes was not of much significance towards yield either from plant to plant of the same strain or from one strain to another.

The correlation of yield to other characters was significantly more in normal plants than in those attacked by the shoot borer (*Earias sp.*) A study of the regression of the plant yield on these characters showed that the relation of monopodia and to a large extent of height was rectilinear. This shows a proportionate increase of yield with increase in these characters. The regression on nodes was more complex.

From an examination of yield from bored and normal plants in all the strains, it was found that the attacked plants gave a significantly higher yield. This increase of yield was associated with an increase in the number of monopodia per plant, as well as an increased rate of productivity per monopodium. It was also observed that the higher on the main stem the attack, the greater the yield. This was not however the case from one strain to another.

From a comparison of other strains, as Cambodia and particularly Uppam (*G. herbaceum*) where the effect of the borer was just the reverse, it was shown that the difference in behaviour could be attributed to the more monopodial habit of this type.

The relation of yield to monopodia was much higher in this Cotton than in more sympodial types as Americans or Uppams' Selection for high yielders on the basis of monopodia is justifiable in 'Northerns' Cotton.

Acknowledgments. To M.R.Ry. K. Gopalakrishna Raju Garu, Deputy Director of Agriculture, Bellary, we are indebted for facilities. The work on Uppam cotton included was done while the first of the authors was an Assistant in the Madras Herbaceum scheme financed by the Indian Central Cotton Committee.

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A NOTE ON CLOVE CULTIVATION IN SOUTH INDIA

(*From The Director of Agriculture, Madras.*)

Botanical Origin and Distribution: The clove is known botanically as *Eugenia caryophyllata* and belongs to the family *Myrtaceae* to which the Myrtle, Eucalyptus, Rose apple and other well-known plants also belong. It is a small conical tree 30—40 feet tall and it is a very slow grower. It is said to continue prolific up to 75 years in favourable localities.

The clove is said to be indigenous to five small islands in the Moluccas, but it has spread through the agency of man to many parts of the tropical world and it grows particularly well in the islands of Zanzibar and Pemba which produce the greater part of world's supply. The clove is also grown in the Tinnevelly District and on the southern slopes of the Nilgiris of the Madras Presidency on a small scale, where it thrives up to 2,500' elevation.

Cultivation: The clove prefers a somewhat sandy soil and a well distributed annual rainfall of not less than 60". The seeds should be collected for sowing as soon as mature, i.e., when the seed covering becomes soft and purple in colour. They should be sown as soon as collected in nursery beds made up of any good garden soil to which a quantity of sand and leaf mould has been added. Select a site away from the roots of trees and dig the ground to a depth of one foot or more. The width of the beds should not exceed 4 feet, the length being determined by the number of seeds sown. The seed beds should be covered with a pandal to keep off the sun's rays, and the soil kept moist, but not waterlogged. Germination will take place in about six weeks, when more light should be given, otherwise the seedlings will become weak and leggy. The seedlings should be transplanted to planting baskets or established in balls of soil and moss when about 6" tall and grown on for planting out in their permanent quarters the following rainy reason. A month or two before the planting season, say in April, pits 3′ square and 3′ deep and 20′ apart should be dug, and if the soil is poor, half filled with the soil removed from the pits and the other half made up with tank silt or any available good garden soil containing plenty of humus all well mixed together. As soon as the South West monsoon begins, the young seedlings should be planted out in the centre of the pits in the baskets or balls of moss without disturbing the roots. On no account should the plants be allowed to become dry until they are about 3 feet tall after which weekly irrigations during the dry season should suffice.

Clove trees may conveniently be grown between fruit trees in already established orchards wherever there is sufficient room, as they do not require much lateral space. For new orchards nutmegs, cloves, mangosteens and loose-jacket oranges would make a good mixture, with papayas and plantains put out between as a catch crop. All these thrive under similar climatic conditions and the water requirements of the different species of trees can be regulated by irrigation. Mixed planting, however, requires a good deal of judgment and forethought and should not be undertaken without expert advice. If cloves are to be grown separately a green manure crop might with advantage be grown between the trees. This could be cut to provide a mulch to the trees during the dry season and would also prevent soil erosion on steep land during heavy rains. I suggest *Tephrosia candida* or one of the Crotalarias as suitable plants for this purpose, or on very steep land *Leucana glauca* would be a useful plant, but the latter requires constant cutting to keep it within bounds.

The clove tree comes to bearing in from 10 to 15 years from planting and attains its full cropping capacity in about 20 years when from 8 to 10 lbs. of dry cloves per tree may be expected. In the Tinnevelly District the yield is estimated to be between 1500 to 2000 lbs. of dry cloves per acre if the trees are planted from 15 to 200 feet apart, giving from 100 to 150 trees per acre ; but this figure is, in my opinion, very much over-estimated as allowance must be made for a large percentage of the trees not producing crops annually. A nearer estimate based on yields obtained in other parts of the world is 800 to 1000 lbs.

The clove of commerce is the unexpanded flower buds and these are gathered from the trees when they are dull blood red in colour. Gathering should be done in fine weather and the cloves spread thinly on mats in the sun to dry, which takes about a week if the weather is dry and longer during dull weather. At nights, or if rain occurs, the cloves should be removed to a light airy shed and spread out thinly until the weather becomes fine again. In some parts of the world cloves are dried over artificial heat and these are said to be a brighter brown and therefore more pleasing to the eye than the sun dried ones. The clove loses from 50 to 60 per cent. of its weight in drying.

The price obtained in South Indian bazaars is roughly Re. 1 per lb. for good quality cloves. The wholesale price in England varies from 8 d. to 1 s. per lb.

Cost of planting and maintenance: The charges for the first ten years are estimated to be Rs. 1,500 per acre, but this must necessarily vary in different districts. Thereafter the probable cost of maintenance such as weeding, forking, mulching, etc., would be about Rs. 100 per annum.

N. B. Clove seeds and plants are available at the Agricultural Department Experiment Fruit Station at Burliar in the Nilgiri District, price of the former being Re. 1 per 100 and the latter annas four per plant or Rs. 15 per 100. Seeds can be supplied in September each year.

* INSECT PESTS OF ORANGES IN THE NORTHERN CIRCARS

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In the N. Circars orange cultivation is carried on, on a fairly extensive scale. The citrus gardens round about Ellore, in and around Palacole and in the vicinity of Rajahmundry in the Godaveri District, and those in the districts of Guntur and Kistna furnish a very imposing sight. The chief varieties grown are the Batavian oranges (*Citrus sinensis*), the Pomelos (*Citrus decumana*), the Sour lime (*Citrus medica* var. *acida*) and the country oranges (*Citrus aurantium*); of these the Batavian forms the most noteworthy. This variety is found to come up well in almost all soils such as sandy or red loams and typical red soils. It requires timely irrigation and the importance is well evidenced by the presence of large wells in these gardens. Good drainage also appears to be essential, since water-logged conditions affect the tap root. The trees are planted 20 to 35 ft. apart They begin to bear after seven years and normal bearing begins after ten years. Various manures are applied, such as tank and canal silt and horse and cattle manure. This is done during December, and irrigations are given immediately afterwards, the idea being to induce early flowering which commences during December—January. During the beginning of July, the fruits are ready for basketing which is done to induce good colour and early ripening. A month or a month and a half after basketing, the fruits will be ready for the market. The price of the fruits usually varies between Rs. 30 and Rs. 50 per 1000, each fruit selling for an anna or two. Though a paying crop, there is loss in certain years due to insect attack and as such, the fruit-grower in these parts will do well to get some knowledge of these pests and the possible methods of their control.

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* Paper read before the Ind. Sci. Congress, Patna 1933.

The object of this paper is to record some of the observations made regarding citrus pests, during the period of two years 1930—31 and 1931—32, when the writer was stationed at the Agricultural Research Station at Anakapalli, Vizagapatam Dt.

The following are some of the pests noted on citrus.

The Fruit-Sucking Moths, so called on account of their habit of sucking the juices of fruits by means of their sharp sucking tube, are widely distributed. Here is an instance where the adult or the imago is able to cause damage to a crop. The minute punctures caused on the rind develope bacterial activity and the fruit consequently turns yellow and drops down. Fruit-fall is a very common occurence in infested orange gardens. The moths attack pomegranate and mango also. More than one species is concerned in the damage, *Ophideres materna* and *Ophideres fullonica* being the chief. The adults are beautifully coloured and may be mistaken for butterflies. These two important species are distinguished by the differences in the wing coloration.

These moths deposit their eggs usually on *Tinospora cordifolia* (*Tippa Tiga* in Telugu) commonly found among hedges and cactus bushes. The hatched-out larvae feed on the leaves of these creepers and when fully grown are about 7 to 7½ cm. long. They are stout and semilooped, forming a characteristic S-shape when disturbed. The larvae show a great deal of colour variations and they are speckled with orange, blue and yellow spots. The anal segment is characterised by bright yellow patches behind and on the sides. In the case of *O. fullonica* the caterpillars are deep greyish-brown with five pairs of prolegs whereas there are only four pairs in *O. materna*. The larvae before changing into a dark brown pupa spin a tough cocoon among the dried leaves. The pupal period varies between 10 and 16 days.

Control: This is a very important pest in this tract causing appreciable loss and deserves some special notice in the matter of control measures. Removal of larval food plants by the gardeners with concerted action among themselves would mean prevention.

In the Circars there is the practice of covering the fruits with baskets, made of palmyra leaves and costing Rs. 1/4/- to Rs. 2/- per 1000. This is done a month or a month and a half before harvest and is done mainly to induce good colour, and the idea of protecting the fruits by means of these baskets may after all be an afterthought. After basketing is done fruit-fall is considerably reduced. Occasionally fruit-fall is noticed both in the case of basketed and unbasketed fruits. One is inclined to ask how far basketing of fruits is effective in preventing the moth-attack. Not only this. These baskets are made of palmyra leaves and the latter are not intact and the moths could easily pierce the fruits through the crevices. If the basketing should prove effective, the fruits should be basketed earlier than is done at present which may affect the development of the fruit. Round about Ellore the fruits are covered with lotus leaves. These are not as good as those with palmyra leaves, because the former become dried up soon and tear off easily and the fruits are pecked by birds too. It would be of interest to note that it is reported by gardeners that basketing of fruits with lotus leaves prevent fruit-moths' attack on account of the peculiar odour the leaves possess. This is also a point worth investigating.

Spraying the fruits with Crude oil emulsion and handnetting the moths during nights have been found to produce good results.

The Citrus Butterflies: The caterpillars of these butterflies feed on the foliage and the damage to young plants is more serious than to the trees. There are three species generally concerned in the damage; these are *Papilio demoleus*, Linn., the popular lemon butterfly; *Papilio polytes*, Linn., which is noted for its mimicking female forms; and *Papilio polymnestor*, Cram., a very large butterfly with dark and blue shades and markings. These butterflies are commonly seen flying about in all gardens during day time.

The mother butterfly generally lays the smooth rounded eggs singly on the tender parts of the plant. They are pale yellow in the case of *P. demoleus* and yellow in the case of *P. polytes* and in the case of *P. polymnestor* the eggs are bigger. The egg period in the case of *P. demoleus* is 4 days. The fully fed larva is stout and sluggish with small head, stout thorax and gradually tapering abdomen. The larvae show a good deal of variation in colour and markings in the early stages and resemble dropping of birds. The fully fed caterpillars may be distinguished as follows. In the case of *P. demoleus* the larvae are blue, pale blue, or sometimes pale green with yellow tinge with dark dorsal spots. The forked reddish brown process behind the head (Osmeteria) is very long. The larvae of the other two species are velvety green in colour. In general the larvae of *P. polytes* and *P. polymnestor* resemble very much differing only in size. A fully grown caterpillar of the latter is about 7 to 8 cm. in length. Another noteworthy feature in the larvae is that in the early stages they are pale light green with white dorso-lateral patches on the posterior aspect of the abdomen. Head pale green, thorax stout; when disturbed there is no protrusion of the osmeteria as in *P. demoleus*. The larval period in the case of *P. demoleus* is 13 to 14 days and in *P. polytes* 17 to 21 days. Pupation generally takes place on the stem or the twig; the pupa is attached to the twig by two tough silken strands. The pupal coloration varies a good deal among the three species. The pupal period in the case of *P. demoleus* is 8 to 16 days; of *P. polytes* 12 to 35 days and in *P. polymnestor* 16 to 42 days.

From counts made of eggs and larvae of these insects found on citrus seedlings for a period of nine months, it was seen that the species are found right through the year with the degree of incidence only varying, being very high during the summer months. *P. demoleus* is seen in large numbers during the rainy months between July and November and from then onwards they become very limited in numbers and *P. polytes* and *P. polymnestor* begin to be prominent. From the second fortnight of December *P. demoleus* becomes scarce. The relative proportions of *P. polymnestor*, *P. demoleus* and *P. polytes* are in the ratio of 1:22:17 during the period beginning from the third week of January to the first fortnight of April for nearly four months. The pest is serious only on young seedlings.

Control: In the case of young seedlings, from the time of germination for a year or two they may be examined once in four days only, as the egg period happens to be four days; and the eggs and larvae that may be found on them may easily be hand-picked. This method proved the most efficient; and this was done right through the whole year in the case of the young seedlings. The gardener himself may do this, the time taken to carefully examine 80 rows of seedlings being only about an hour and a half. In addition to this, lead arsenate solution (½ ounce, in one gallon of water, diluted with equal quantity of lime) was sprayed occasionally on the seedlings and the insecticide proved effective to a great extent. The seedlings undergo growth and consequently fresh foliage is put forth and this would mean frequent sprayings. Ordinarily handpicking of eggs and caterpillars is the best, efficient and economical method especially in the case of nurseries, where alone the pest is serious.

Lycaenid Butterfly: (*Chilades laius*, Cram.) The caterpillars of this common coppery blue butterfly eat the tender leaves, and now and then prove serious to young seedlings.

The eggs are very minute, white, corrugated and are flat on both the sides. The single eggs are laid indiscriminately on the terminal foliage, on the leaves, petiole, stalk etc., and sometimes may be found in groups of two, three or even a dozen. The egg period is about three days The larvae on hatching begin to scrape the young leaves and as they grow in size the leaves are eaten away. The mature larva about 10 mm. in length is green, stout, spherical on the dorsal side and flattened below. It is soft and sluggish in habits and remains a larva for about 6 days. The pupa generally found on the leaf is green in the early stages and later on turns dark green. The pupal period occupies 7 to 8 days. The longevity of the adults has been recorded as 3 days when fed with molasses. The pest may be found on the seedlings right through the year abating now and then.

Control: The measures are the same as in the case of Papilios, viz., handpicking of eggs and caterpillars and frequent sprayings with lead arsenate solution of the strength mentioned above.

The Citrus Leaf-roller: (*Tonica zizyphi*, Stn.) The caterpillar of this small moth is also a serious pest of citrus seedling. It attacks the tender sprouting leaves causing them to fold longitudinally and the creature remains inside the fold, scraping the leaves in the early stages and later on eating the leaves from the tip towards the petiole.

The minute eggs are laid on the leaves. The just-hatched larva is pale yellow with black head. When fully fed it turns green and measures about 10 to 12 mm. in length. It is also long and slender with the head black. The body is slightly tapering at both ends. The caterpillar is highly sensitive and when two meet each other they suddenly rush back. The movement is very quick characterised by sudden jerks. Just before pupation it turns pinkish on the dorsal side. Pupation takes place in a silken cocoon inside the leaf-fold. The pupae are green at the outset but later on turn dark brown. The pupal period runs to 6 days, The longevity of the adults when fed with molasses was found to vary from 7 to 20 days.

The pest is noted on the seedlings almost throughout the year. During the rainy months (August—January) the degree of incidence is very high. Subsequently they are found only in limited numbers Beginning with August the incidence is very high till the first fortnight of January. The degree of attack to seedlings was so high that the plants showed only stalks, all the tender leaves being damaged. During February they were almost absent and in March stray cases were found. The pest is always present whenever there is a good flush, as it always prefers tender foliage.

Control. The measures are the same as in the two previous cases viz., handpicking of caterpillars and spraying with lead arsenate solution.

The Citrus Leaf-miner : (*Phyllocnistis citrella* Stn.) The injury to citrus plants results by the miners traversing beneath the epidermal layer of the leaves—both tender and old. The miner always has a partiality for tender leaves which are damaged badly. As the miner feeds in a zig-zag fashion curls are formed resulting in the stunted growth of the seedlings. Gradually the places traversed by the miner undergo browning and put on a scorched appearance; and as the leaves begin to grow at this stage they become torn in these places. The pest is serious in the case of very young seedlings where growth is retarded a great deal. In the case of trees, this does not appear to matter much.

The tiny little moths could easily be recognised by the presence of a black spot at the tip of each ~~wing of the~~ forewing~~s~~. They lay smooth, transparent, spherical eggs on the tender newly sprouting leaves alongside midribs on both sides, and sometimes on the tender stalks. The newly emerged miner begins to mine or tunnel beneath the epidermal layer which can be seen as a thin brown, membranous film and feeds from within. The fully fed miner is about 3 mm. in length and pale brown in colour and when taken out of the tunnel curves itself and wriggles and falls down and the motion is by rolling. In the case of the larva the head region is stouter. The miner is legless characterized by a tapering head. It pupates near the margin of the leaf always inside a curl beneath a tough web of silk. The pupa is light brown in colour. In the case of the pupa each of the abdominal segments bears a pair of hair-like bristles laterally, arising from warts which are hyaline; at the posterior end carries a pair of short stout triangular processes. On the ventral side each of the abdominal segments bears a number of short spines which become more and more distinct posteriorly; those on the last seven segments are distinct and the spines are brown and slightly recurved. At the anterior end there is a dark process appearing as though the head portion ends in a pointed process. The region of the eyes is dark brown. The adult emerges by making an opening at one end of the web. The miners are noticed in the leaves of *Murraya koenegii*, *Pongamia glabra*, *Jasminum*, *Aegle marmelos* etc.

Control: Owing to the miners remaining beneath the epidermal layer of the leaves, it has been found difficult to control these insects. Four methods were tried viz., insecticidal, cultural, biological and mechanical. Crude oil emulsion was found ineffective as the same does not appear to soak through the thin epidermal layer; but in the case of tobacco decoction stray miners were found dead in the treated leaves. The eggs and pupae do not appear to be affected. Even in the case of tobacco decoction, it is not a preventive and sprayings have to be repeated frequently at least once in ten days, as fresh leaves are put forth resulting in fresh attacks. Bordeaux Mixture was tried as a deterrant with no effect. Therefore in the case of insecticidal trials the sprayings have to be repeated and if the pest persists right through the sprayings may have to be given frequently. Moreover the spray fluid may not reach the underside of the leaves. Thus the scope is very limited. As regards *cultural methods*, observations made during two seasons go to show that soon after good showers, the seedlings recover beautifully well. Even otherwise copious irrigations coupled with treatments with tobacco decoction at a strength of one pound in 5 to 6 gallons of water were found to give results during periods of heavy miner infestations as the plants begin to put forth more vegetative growth which minimise the infestation a great deal. This extra output of foliage leads to a less concentration of the pest. If the plants are weaker and stunted in growth there will be greater concentration of the pest. Tobacco decoction on the seedlings was found to act as a good stimulant. Coming to the *biological method*, though chalcid parasites are noticed on the miners during certain months, scope for this method is limited. With reference to *mechanical means* whenever there are very bad infestations handpicking of the mined leaves will reduce the infestation.

The Citrus Shoot and Bark Borer: This caterpillar is noted to damage citrus by boring through the shoots in the gardens round about Palacole and Rajahmundry. Injection of chloroform and creosote mixture was found effective. Further studies have to be made on this insect.

The Citrus Mealy Wings: (*Aleurocanthus spiniferus* Qt.) These minute creatures are fairly common on citrus from July onwards till next March. Observations go to show that between each brood a month may elapse each lasting about a fortnight.

The minute white eggs are laid arranged in concentric circles on the underside of the leaves in the nature of a spiral; they gradually turn brown. The just hatched nymphs distribute themselves on to the whole leaf surface so much so the leaf turns black. These feed by sucking the sap from the tender foliage. Owing to the feeding of the nymphs in large numbers and due to the secretion of the honey dew, sooty mould is formed on the leaves.

Control: The trials to kill the nymphs with tobacco decoction, crude oil emulsion, potash fish oil soap and Bordeaux mixture did not prove effective. The best time to spray is when the adults begin to emerge. But if the broods happen to be irregular then very frequent sprayings may have to be given which may not prove economical, when we take into consideration the extent of damage caused by the pest.

A Coreid Bug: (*Dasynus antennatus*) is noticed in some of the gardens round about Rajahmundry in small numbers. Numerous adult bugs and nymphs are often found on a single fruit; but the damage does not appear to be serious and no punctures or rotting of any kind is seen on the surface. The only injury seems to be to make the fruits turn yellow and ripen earlier. These can be controlled by hand-netting.

The Jasmine Bug: (*Antestia cruciata*, Fb.) which generally attacks jasmine in certain parts of the province is often reported from Rajahmundry on citrus. These are found in numbers on branches and leaves, more particularly on "Kuranji" variety. The bug sucks the juice causing white patches on the leaves and flowers which fade and drop during the flowering season. Handnetting the bugs will be found effective.

The Red Tree Ant: (*Oecophylla smaragdina*, Fb.) This notorious insect is common in almost every batavian garden round about Rajahmundry and other places. It is also found on mango and other fruit trees. The nests are found made among the leaves by means of webbing sometimes enclosing the fruits also. The insect has powerful stings and is a nuisance to gardeners. The nests may be destroyed with poles.

Minor pests: The *Cockchafer* beetles (*Aserica* sp.) are found to eat leaves during night time. Spraying with Bordeaux mixture may be tried as a deterrant. Weevils of different species, chiefly *Myllocerus* are noted to eat the leaves and dusting the leaves with calcium arsenate diluted with lime may be done with good result. The scale insects *Aspidiotus aurantii*. Mask. and *Psudococcus corymbatus*, G. are occasionally noted on the shoots and leaves. Species of *Aphids* called the "Citrus Aphid" are common on young shoots causing leafcurls in young plants and these can successfully be tackled by a spraying with tobacco decoction. There are also *mites* on the leaves and fruits which produce small white dots. Occasionally *Psychid* caterpillars may be found eating the leaves and these may be checked by a spraying with lead arsenate solution at the usual strength.

General Remarks: Of the above pests, fruit-moths may be considered as the major pest of citrus. So far as the seedlings in the nurseries are concerned, the leaf-miners and the leaf-eating caterpillars such as the Papilios, the citrus leafroller and the Lycaenid may prove serious. On the Agricultural Station at Anakapalli, all these four pests were found simultaneously on the seedlings throughout the year with varying degrees of incidence. And recourse was taken to frequent sprayings with lead arsenate solution; and hand-picking was resorted to systematically thus keeping the seedlings in good condition.

In the case of young seedlings, at certain stages, they look very much stunted in growth and any incidence of insect attack is greatly augmented by certain other causes. For instance, when the seedlings are kept in cut pots and then placed above ground, one finds stunted growth and the insect attack is accelerated. But when the pots are buried flush with the ground level and then watered, one finds the same seedlings coming up very well as could be seen by the amount of foliage put forth. Thereby the insect attack is greatly mitigated. Same is the case when the seedlings are given a drenching with tobacco decoction at a strength of one pound in 5 to 6 gallons of water at an interval of a week. One finds a good flush. It has been the experience of the writer that the seedlings put on good flush on receipt of a shower, thereby showing that a certain amount of frequency of irrigations is necessary in the absence of showers. The broad principle underlying this study is that under particular conditions the degree of incidence in the case of any pest will range about a point. Under this degree of insect attack, the plants fare badly with a certain output of foliage. If by cultural means, one is able to improve the condition of the plants, thereby inducing them to put forth good foliage, the degree of incidence being the same, with the increase of leaf surface the insect attack is greatly mitigated. This is the observation which the writer was able to make while studying these pests. Under normal conditions, seedlings may require a particular degree of watering, manuring, etc., when there is no pest. But during periods of infestation, the plants suffer ; normal conditions are upset and consequently one may have to change the treatments given under normal conditions so as to suit the changed conditions. This would mean an extra irrigation or an extra dose of manuring or something in the nature of a stimulant like tobacco decoction. Cultural methods of this kind would go a long way, if need be, supplemented by mechanical methods, in mitigating severe infestations.

In order to make the paper very brief details pertaining to descriptions, insect habits and the degree of incidence in each case have not been given in full. The thanks of the writer are due to Dr. T V. Ramakrishna Ayyar, Government Entomologist, Coimbatore for advice and suggestions and for identifying the species; and to the then Deputy Director of Agriculture, I Circle, Mr. A. C. Edmonds under whom the writer worked during the period for affording opportunities to study these insects.

List of Pests of Citrus arranged according to the Different Insect orders.

ORDER: LEPIDOPTERA

Family *Noctuidae:*

Ophideres fullonica, Linn.
Ophideres materna, Linn.

Family *Papilionidae:*
Papilio demoleus, Linn.
Papilio polytes, Linn.
Papilio polymnestor, Cram.
Family *Lycaenidae:*
Chilades laius, Cram.
Family *Oecophoridae:*
Tonica zizyphi, St.
Family *Phyllocnistidae*:
Phyllocnistis citrella, Stn.
Family *Psychidae*.
Family *Arbelidae*.

ORDER COLEOPTERA

Family *Melolonthidae*:
Aserica nilgirensis, Shp.
Family *Curculionidae:*
Myllocerus evasus, Mshl.
Myllocerus dentifer, F.
Amblyrrhinus poricollis, Boh.

ORDER HYMENOPTERA

Family *Formicidae:*
Oecophylla smaragdina, Fb.

ORDER RHYNCHOTA

Family *Coreidae*:
Dasynus antennatus,
Family *Pentatomidae*:
Antestia cruciata, Fb.
Family *Coccidae:*
Aspidiotus aurantii. G.
Pseudococcus corymbatus, Mask.
Family *Aphidae*:
Family *Aleurodidae:*
Aleurocanthus spiniferus, Quaint.

ORDER ACARINA

Species of mites.

AGRICULTURE IN RUSSIA

BY A. MUIR, B. Sc.

Russia is a country of almost immeasurable agricultural possibilities. Its enormous area covers one-sixth of the earth's surface, and its climate ranges from Arctic Siberia in the North to the almost tropical Caucusus in the South. Between these extremes lie the vast forest regions and the great steppe zone, with its large expanse of fertile black soils, ideally suited for crop production. A further variety of climate and soils is found in the mountainous southern regions—the Crimea, the Caucusus and Turkestan.

The revolution in Russia in 1917 brought about an abrupt transition in practically every phase of national activity; in agriculture the complete change over from little more than primitive systems to large scale productions by modern methods presented problems of special difficulty. In order to appreciate the magnitude and the complexity of this task, it is necessary to review very briefly the conditions of work and life on the land prior to the date of the revolution.

Under the primitive conditions obtaining almost up to the time of the revolution, the two main classes in agriculture were the land-owning class and the peasant. Until 1861, the lot of the peasant in Russia was exactly comparable with that of the bondman under the feudal system in Britain. In that year the peasants gained a certain amount of freedom, but the conditions of life and work changed but slightly. Only to a very small extent was the peasant master of his own destiny. The land-owners in some cases were genuinely interested in the welfare of their small tenants and peasants, but the large majority was interested only in the revenue which could be obtained from the land. The peasant had to do a certain amount of work for his master, and he generally managed to farm a small patch which would keep him and his family during the year. In some places, the village owned or rented a large area, which was divided up among the villagers and run on the three or five-field system. Here, the villagers had to pay the rent for the land either in money or in kind, the landlord taking no interest in agriculture.

Until towards the end of last century the landowners as a whole were content to produce only enough to satisfy the internal requirements of the country, and large-scale farming was of very small importance. About that time, however, it began to be realised that the vast tracts of black-earth soils were an enormous asset, since they could be worked for long periods under one crop without showing any signs of falling off in crop yields. Scientific men, notably one Dokuchaiev, turned their attention to the study of this soil and founded what is now known as Soil Science. It was still some time, however, before agriculturists began to make serious use of the results of scientific research, and in the end it fell to a land-owner in the South to form the first experimental farm. This he did on the lines of the Rothamsted Station, as it was begun by Lawes. Others followed this lead, and at the beginning of the present century, we find farming on a larger scale than had formerly been possible.

The improvement in methods of cultivation did not, however, do much to bring about the desired increase in yield owing to the extensive of farming which still prevailed. The average yield per acre in Russia for the period 1901 to 1919 was 1—3/4 qrs. wheat, 2 qrs. barley and 3 tons potatoes. During these ten years there was a slight decrease in that of barley, but on the whole these changes had little effect on the total output. The fluctuations in yield over a period are remarkable. Thus taking the lowest for spring wheat over the period 1883 to 1898 as 100, we find that the highest is 336. Live-stock showed a large decrease during 1900 to 1912, reaching in the case of sheep and goats 27°/o. Only in the case of horses was there an increase (5·7°/o).

An explanation of these decreases is found in the amount of land per head of population. The agricultural population increased from about 50 millions in 1860 to 86 millions in 1900, resulting in a corresponding decrease in the amount of land per head of population. This decrease in some cases amounted to about 50°/o, i. e. from 12 acres per capita to 7 acres. This "land hunger" caused great hardship among the peasants, lowering the amount of stock the small farms were able to carry, and in general lowering the standard of living of the peasants. To alleviate this suffering, the Asiatic Colonisation Bureau was formed. This Bureau sent out expeditions, which made detailed surveys of various districts and contributed greatly to the knowledge of the country. On the basis of this work peasants were transferred to Asiatic Russia and found there a rich and fertile country.

The first revolution of 1905 had brought very few changes in its wake, and the peasants were very ready to follow the lead of the town workers when the great revolution of 1917 took place. Having thrown off his yoke of servility, the peasant simply carried on his farming in the old way. None of them was rich enough to purchase the new machinery, and that which belonged to the rich land-owners was often destroyed, and in any case there was not enough to go round. The problem which confronted the new government was how to apply the Marxian theory of economics to such a great problem. Lenin summed up the position in the following words: "To live the old way, to live as people lived before the revolution is impossible, and such an expenditure of human strength and means as is connected with peasant farming can no longer continue. The productivity of human labour would be doubled and trebled if the transition from these scattered farms of small size to socialised farming could be made."

The socialization of agriculture has proceeded along two lines—the formation of state farms (*sovhozes*), and of collective farms (*kolhozes*). Farms of both types were formed immediately after the revolution, but these did not become factors of any importance until recently. From 1921—27 there was a large decrease in the number of the most highly collectivised farms, due simply to over-eagerness on the part of those sent out to organise them. Those chosen were no doubt good communists but bad psychologists, as was shown by their failure to find the proper approach to the humble but suspicious peasant. Many of the brigadiers, as they were called, had absolutely no knowledge of practical farming.

The "*sovhoz*" is run by some trust which is directly responsible to the Central Government. Each farm has a manager, mechanics, labourers, etc., who are simply paid servants of the State, and are in no way affected by the success or failure of the crops. These farms, which in some cases have reached a colossal size, e.g., the Giant in the North Caucusus, which has an area of 450,000 acres, are the basis of present day agriculture in Russia and towards this form all others tend. In the collectivised sector there exists three types of farms. The first and most primitive is simply an association for the joint tillage of the soil. The products of the land are divided up at the end of the year according to the amount of land owned by each family. This is only the first step towards further collectivisation, of which the "*artel*" represents the second. Here we have almost complete collectivisation, each family being left only one cow and their hens for personal use. In the final stage of collectivisation—the commune—everything is collectivised, except, of course, personal belongings. This state of affairs is found but rarely, the peasants being encouraged to increase the productivity of the land rather than bother about communal houses. The collective farms are run by a committee elected by the villagers, and sometimes, if the village is small, all the villagers may take parts in the work. A president and secretary are chosen by the committee, and they together act as the executive body. An agronomist is generally to be found in each village, but if the district is sparsely populated, one agronomist has to suffice for the whole district. Attached to many of the farms are tractor stations, which are assuming greater importance as the production of tractors increases. The Stalingrad factory was recently producing about 110 tractors per day and the Leningrad factory about 90. The chief difficulty found in the use of tractors is the lack of spare parts, and it is not uncommon to find most of the tractors in one station laid up owing to some minor trouble. The peasants have on the whole taken fairly well to the mechanisation of agriculture, and are ready and willing to learn the handling of the various modern machines which are now at their disposal. The working day is generally one of ten hours, but weather conditions and other factors outside the peasants' control may necessitate much longer hours sometimes. Lateness in the delivery of seed, an increase in the sowing area and mechanical break-downs in machinery are common causes of delay, giving rise to the necessity for extra work. During the sowing and harvesting season it is not uncommon to find a night-shift being worked with the aid of head-lights. The area sowed must be increased every year, and every district is required to furnish a detailed programme for each financial year. When the total production falls short of the requirements of the plan, the area is increased very often without any regard to the capabilities of the peasants and the conditions under which they work. This is generally responsible for many of the poor crops very often produced by the collective farms. When the harvest is brought in, the government takes a pre-arranged portion at a fixed price. The remainder is divided among the members of the farm. In some cases, the whole of the produce is sold and the money received divided up according to the amount of work done. A strict record of the work performed by each member of the farm is kept, and it is according to this record that the final division is made. Quality counts just as much as quantity. The contract system has been applied in certain cases in order to ensure that there would be sufficient supplies available to the government for State marketing. This system also ensures the peasant a higher standard of living than he would otherwise obtain. More up-to-date machinery and implements are granted to those farms contracting, and the transition to collective farming is thus rendered easier. Some idea of the proportion of crops contracted for, in relation to total area sown, is given in the following table:—

Crops.		1928 per cent.	1929 per cent	1930 per cent.
Summer corn	...	4·3	25·0	30·0
Winter corn	...	14·7	32·7	...
Cotton	...	100·0	100·0	100·0
Flax Fibre	..	20·5	36·8	37·9
Sugar beet	...	100·0	100·0	100·0
Tobacco	...	66·3	74·9	100·0

This system is being applied more generally each year, and production by this method will eventually reach 100 per cent. for every crop. Recently new regulations have been introduced to allow the peasants to retain a larger proportion of this products than formerly, but these will not affect the contracting system.

The status of women on these farms is the same as that of the men. They enjoy as much freedom and their work counts equally. In most villages, creches have been established where the children are well looked after by a trained teacher or nurse, while their mothers are at work in the fields. When the children reach the age of seven, they must attend school. At that age, most of them have learned to read, write and count, and they continue at school until they are fifteen. Under the old system it was very difficult for a peasant to proceed to the University, but that is now changed, and while the student is attending classes, he receives a grant which enables him to live without depending on his parents for everything.

In most farms, as in factories the peasents form themselves into "*Shock brigades*", and these vie with one another in producing the best results from their labours. These "*Shock brigades*" generally set themselves a definite piece of work and then strive to get it done as quickly and efficiently as possible. Their rewards are more spiritual than material. If a brigade is highly successful in its work, it may gain a Red Banner, which is a much coveted award. Individual members may be awarded the Order of Lenin, but this is given only after long service with the party. Sometimes members of the "Shock Brigades" receive gifts in kind, and the writer was present at a distribution of such awards when these included an overcoat, a pair of boots a primus stove, a samovar and so on.

An interesting series of figures was given by Jakovlev in 1931 for the distribution of collective farms in relation to three of the main regions of the country.

Percentage of collectivised farmers to Total Number of peasents.

Region.	1928 per cent.	1929 per cent.	1930 per cent.
North Caucusus, Lower and Middle Volga and the Ukrainean Steppes.	3·5	7·4	48·8
The rest of grain producing areas.	1·6	4·0	25·5
The consuming regions	0·5	1·5	8·5

The figures for 1931 show still further increases. The explanation of the large difference is easy to find. The peasants in the vicinity of large towns find it more profitable to remain outside the collective sector and to sell their produce in the open markets in these towns. In the other regions they have not the same facilities, and therefore it is much easier to get them to collectivise. Of course, the first and second regions being the chief grain regions, the government paid special attention to the collectivisation of these districts. There is difficulty in forming large farms in the north owing to the occurrance of great tracts of forest and peat bogs. Very little attempt is made to cultivate the peat, but it is largely used as fuel, since in the north, especially in the Leningrad region, there are no coal deposits of any importance. To compensate for the lack of coal, however, the north has very extensive mineral phosphate deposits, which are used to supply the large phosphate deficiency found in all the northern soils. The main crops in the north are flax, oats and rye. Attempts are now being made to concentrate around the large towns market gardens, which up to the present have been scattered over a fairly large area.

The transition to modern farming methods has thus been going on with varying degrees of success since 1917. During the period of civil war the area under crop decreased by about 20 per cent and did not reach the pre-war level again until 1925. During the last few years, however, the grain output of the country has increased enormously, as can be seen from the following figures. Two sets are given, one for the collective farms and one for State farms.

Year	State Farms.	Collective Farms.
1927	... ...	2·0 mill. cwt.
1928	6·4 mill. cwt.	3·6 ,,
1929	7·9 ,,	12·7 ,,
1930	18·0 ,,	82·0 ,,

Figures for 1931 are not available, but the increase in production certainly would be continued, as a much larger area was under crop. The expected yield would not, however, be obtained owing to the fact that weather conditions were most unfavourable to cereals during the whole growing season.

To conclude this brief account of agricultural conditions in Russia, a few notes on agricultural science may be added. Agricultural science in Russia may be said to date from the 18th century, but in most branches the contributions of Russian scientists were very meagre until the 19th century. During that century the possibilities of expansion in the agricultural markets gave science the necessary impetus, and towards the end of the century we find the Russian scientific men coming into their own. The study of the soil as a natural body was the chief contribution from Russia. In 1883 Dokuchaiev issued his monumental work on the Russian Black Earth, and the principles which he laid down in that work have become the foundation stones of the modern study of the soil. The practical aspects of the problem were not ignored, but the Russians felt that a thorough study of the actual processes of soil formation would give in the end a more complete picture of the conditions obtaining in the soil and hence a surer basis for rearing the structure of applied soil science or agronomy, as it is now known.

Dokuchaiev had many illustrious pupils, and these in turn carried on the task of making a complete study of the soils of their vast country. Small-scale maps of both the European and Asiatic parts of Russia have been issued, and an attempt is now being made to cover every important part of the country on the scale of 1 inch to the mile. These soil surveys are made the basis of any agricultural expansion and for the introduction of new crops. In other branches of agricultural science, the achievements of the Russian scientists have not been so marked. Since the revolution, the net-work of agricultural experiment stations has been brought into better co-ordination, and all problems are investigated on a co-operative basis. Thus, instead of each station working away independently on its own region, the problems cropping up in that region are attacked by a number of institutes, and thus the final results are far more valuable than if each had pursued a line of work regardless of others. This co-operation is seen in the so-called "complex" expeditions which are sent out by the Academy of Sciences. We may take as an example the expedition sent out to investigate the Salt Lakes of Siberia. It was well-known that the salt content of the lakes was high and that it would prove profitable to work them. However a difficulty at once arose from the fact that in the neighbourhood the soils were so impregnated with salt that cultivation was impossible. Thus to investigate the region properly, there were needed: geologists to study the salt deposits and other rocks in the vicinity; botanists to study the present flora: soil scientists to study the soil and advise on the proper methods for bringing it into a state fit for cultivation; lastly, chemists, to study the methods for extracting the salt. The expedition will return again this year for more detailed study of the region.

Time alone will show how this great experiment is going to work out. Many of the difficulties often appear insuperable, but by whole-hearted co-operation they may be overcome. The general backwardness of the agricultural population has been one of the controlling factors, but by raising the cultural level of the people a higher efficiency should be attained. The people on the whole are in sympathy with the new system, and that means a great deal. A rigorous application of Marxian principles to agriculture has proved impossible, but suitable modifications would appear to have been of great value in ordering the life and work of that vast country :— *Scottish Journal of Agriculture, October, 1932.*

Notes and Comments

(1) **The Mannargudi Agricultural Colony.** We cannot sufficiently congratulate the movers of this laudable scheme of establishing an Agricultural colony for the uplift of the rural population—especially at a time when the agriculturist is in need of some real stimulus in this direction. The scheme appears to be to open an Agricultural colony and to impart practical instructions in the different aspects of agriculture to the population and in this way to educate the agriculturists especially of the surrounding area and carry on rural reconstruction work. The Government also have shown their appreciation of this idea by granting a site of about 200 acres of land near Vadavun about nine miles from Mannargudi, Tanjore District. The prime mover of the whole movement is Rao Saheb S. V. Kanakasabhai Pillai, retired P. W. D. Assistant Engineer. Even while in service Mr. Pillai was carrying on silent and unostentatious work in this direction. He

has as his co-worker and secretary Mr. Ramalingam Pillai who received his training in rural reconstruction work at Marthandam. We had an opportunity of getting some insight into Mr. K. Pillai's enthusiasm and earnestness for this work when he had gone over to Coimbatore in connection with a recent Agricultural conference which was held at Mannargudi at his instance. We also understand that Mr. Pillai is arranging to get the services and co-operation of some retired agricultural officers in this work; we need hardly add that it is the duty of all interested in agriculture to help this scheme in all possible ways; especially is it the duty of all agricultural officers and the Department of Agriculture. We offer our sincere good wishes to Mr. Pillai and hope that his well conceived scheme will be attended with success and benefit the country in various ways.

2. **Protection for Indian Silk Industry.** We invite the attention of our readers to a few extracts we reproduce elsewhere in this issue from a memorandum submitted by the Mysore Chamber of commerce to the Indian Tariff Board in connection with the present critical position of the Silk Industry in that state, its national importance, and the consequent need for protection. The chamber has pointed out that owing to the dumping of cheap foreign silk goods especially from Japan and China, the local industry is not likely to develop at all. This foreign competition has seriously affected the silk industry not only of Mysore but of the other parts of India as well. The imports of foreign stuff during the past six years appear to have increased more than [illegible]0 per cent. in volume. And to add to this volume the phenomenal decline in the prices of imported silk hits the local manufacturers very seriously. This free dumping of foreign silk will also affect many a poor farmer who is now attempting to earn something extra by having sericulture as a cottage industry. The chamber has made out a very good case for the Indian silk industry and we hope the Tariff Board and the Government may be inclined to view the position favourably and save this ancient industry in India.

3. **Economic Enquiry Scheme.** Our readers will be glad to note that at a meeting of the joint committee of the Indian Central Cotton Committee and the Imperial Council of Agricultural Research held on the 27th January at Karachi, a scheme was agreed to for an economic enquiry into the cost of production of crops in the principal sugarcane and cotton tracts of India at a cost of five lakhs. This is considered the first enquiry of its kind in India for the development of the sugarcane industry, which recently was afforded substantial protection by the Assembly. This enquiry is also expected to show where exactly it is remunerative to extend the area under sugarcane. The Government of India is giving substantial encouragement to the Imperial Council of Agricultural Research by means of a grant which the Council will utilise for this enquiry. The entire cost

of the enquiry is to be borne by the Indian Central Cotton Committee and the Imperial Council of Agricultural Research on a fifty per cent. basis. The enquiry is to continue for a period of four years, and embrace seven British Indian Provinces. The enquiry in Madras is to be conducted in six selected villages in each of the districts of Vizagapatam, Bellary and Coimbatore, each village being assigned an investigator and each district a supervisor. The approximate cost, so far as this presidency is concerned is expected to be Rs. 48,000 of which three quarters will be met by the Imperial Council and the remainder by the local Government. Further details are expected to be worked out very soon and the work started with the new official year. Such enquiries regarding the important crops grown in the country and the needs of such crops and of those who cultivate them and the future possibilities are practically overdue and the decision of the joint committee is a welcome decision to all those who have the economic welfare and agricultural prosperity of the country. This is a beginning with the two very important crops Sugar-cane and Cotton and we believe such enquiries may be extended to other crops as well in course of time.

4. **Young men to the Land.** A very interesting communique has been issued by the Government of the United Provinces in connection with the appointment of a committee to investigate the feasibility of employing educated young men on lands. The commuique has raised a series of important points, practically as a sort of questionnaire, which demand elucidation from persons interested in the subjects. The more important items relate to the size and extent of land and the number of men to be employed in such cases, the minimum area that may be alloted to each settler, the actual functions of these men, the nature of the crops to be grown, what cottage industries may be added, the nature of the preliminary training they should have if any, the nature of the supervising agency, the funds for the scheme and the preliminary capital each is expected to equip himself with. Those interested in this problem might send their views on these matters to the United Provinces Government to enable them to come to some definite conclusions. We would draw the attention of our agricultural Graduates and such young men who are anxious to work on the land to this communique. We could wish that such schemes are elaborated by every province and avenues opened up not only for the spread of scientific agriculture but also to relieve the present distress of non-employment among the youth of the country.

5. **Fruit culture in South India.** We have to admit that the aspect of agriculture related to pomology and horticulture has not received as much attention from scientific workers or the Government as the subjects deserve. Excepting some attention paid to the trials in growing some temperate fruits on the hills, practically very little has

been done by the agricultural department till now in the way of carrying on researches with local indigenous fruits like Oranges, Bananas, Grapes, Mangoes, etc. for which nowadays there is a great demand. The public have also begun to realise the value of fruit food and many of our educated *men* are anxious to get reliable information in these subjects. It is therefore good news to hear that the Government are contemplating to open a fruit Farm for trials of the different local fruits with an idea of improving the local varieties and supplying information and suggestions to fruit growers all over the province. In our opinion an ideal tract for such an experimental station appears to be Rajampet taluk in the Cuddapah District. The soil and other conditions for fruit growing appear to be quite satisfactory and there exist numerous Orange and fruit gardens all over this area. If the Government have not already come to any definite conclusion we would wish that our suggestion may receive due consideration.

6. **The M. Sc. Degree for Graduates in Agriculture.** The Academic Council at its meeting held on the 30th. January has agreed to recommend to the Senate the amendment of the statutes so as to permit B. Sc. Ag's. to proceed for the M. Sc. Degree by Research and also to recognise the research work already being carried on by such candidates, as being of an " approved " nature for purposes of the above Degree. The matter may probably come before the Senate at its next meeting in March and it is hoped that they will accord timely sanction to the recommendation of the Academic Council and thus afford relief to the long delayed claims of the B. Sc. (Ag.) students, several of whom have already begun their work in this direction in anticipation of the Senate's approval.

Gleanings.

Plant Immunity. A very interesting point of view has stimulated the investigations of Dr. A. C. Leeman into plant immunity. It is recognised that antibody production and related phenomena, as they are associated with the animal body, play no direct part in the immunity of the plant. But it is shown that certain extracts and organic substances play a considerable part in stimulating the resistance of plant to attack by a fungus disease. The substances when added to the soil are harmless to the parasite, but become detrimental when taken into a plant and incorporated with its protoplasm. Secretions and extracts of micro-organisms, and various enzymes, have been found to reduce the damage caused by the parasitic fungus *Helminthosporium sativum*. The interaction of micro-organisms has also been studied as a means of disease control.

(*Nature*, No. 3268. Vol. 129.)

Sclerotial Rice Diseases. Investigations by Messrs. Malcolm Park and L. S. Bertus at the Royal Botanical Gardens, Peradeneya, Ceylon, reveal that *Rhizoctonia (corticum) Solani* not only gives trouble in the potato fields of England, but also causes a disease of rice in Ceylon. It has been found that the ordinary methods of crop rotation are inadequate owing to the longevity of sclerotia in soil. Experiments are, however, being directed towards finding a specific soil treatment. The other disease investigated is caused by *Sclerotium orizoe*. This occurs in patches in the rice growing areas. Methods of control consist in the burning of the diseased patches at harvest time and in preventing irrigation water from running through a diseased field since it might carry infection. It has also been found possible to grow varieties of rice which are resistant.

(*Trop. Agri.* Vol. IX. No. 12 P. 380.)

A Curious Plantain Tree. A plantain tree, of about 14 inches in height, and about 2 inches in diameter, with a fairly large rhizome has put forth an inflorescence. It is about 4 inches long and about 2 inches broad. All the flowers, however, have all their floral parts just like mature flowers. The tree was found in the flower garden of Mr. Kanakasabai Nattar, Perfumery Merchant, Chidambaram. It is preserved in the Museum of the Botanic Laboratory of the Annamalai University. (*Hindu*, 27—1—'33.)

Soap and Oil Industries in South India. South India enjoys an abundant supply of materials for making soap. The utility of some of these was not generally understood before the Government Soap Institute at Calicut showed how various vegetable oils could be profitably employed. The Institute was started at Tanur 17 years ago by Sir Frederick Nicholson, as a branch of the Fisheries Station. Mr. A. K. Menon, Soap and Oil Expert of the Government, made a fish oil soap as an insecticide which by its quality and cheapness soon attained wide popularity. This soap is now used by agriculturists and planters throughout India to destroy insect pests. The Institute gradually extended its field of research and developed new activities, and is at present marketing various kinds of toilet and industrial soaps. Experts and high officials who have visited the institute, have spoken highly of its pioneer work. The Institute has also carried out experiments in the manufacture of lubricating oils and paints, and is also engaged in work on the deodorisation and hydrogenation of oils. India exports oil seeds amounting to over a million tons annually, and a large portion of the oil extracted returns to India, in the form of fats or refined oils. The Institute at Calicut is devising methods which may be employed by peasants and industrialists for the extraction and utilization of these oils.

(*Chemistry and Industry*, December, 16th, 1932.)

Artificial Production of Rain. The American scientists, Professors Warren and Bancroft, have successfully produced rain in a series of experiments based on the natural process which takes place in the upper atmosphere. Moisture is always present in the upper atmosphere in the form of minute drops so light that they remain in suspension. When particles of dust come in contact with the drops of moisture they are absorbed, thus increasing the weight of drops. As a result of their electric charge (positive or negative) the particles tend to become aggregated into masses too heavy to remain in suspension and then fall as rain. Thus, clouds formed of vapour too light to fall as rain may be artificially weighted by electrically charged dust and immediate rain produced.

Acting on this theory a load of electrically charged sand was dropped from captive balloons on to clouds. Rain fell immediately. Prof. Bancroft calculates that 40 lb. of electrified sand would be sufficient to dissolve into rain 1 square mile of clouds.

In subsequent experiments an aeroplane was used carrying sand with a charge, partly positive and partly negative, of 12,000 volts. The machine rose and disappeared among the clouds while spectators below awaited the miracle, which proved even more dramatic than before. The clouds burst in a violent shower of rain, while at the same time the sky cleared and the sun shone again.

In the Netherlands Prof. Veraat has succeeded in producing rain over an area of about 8 square kilometres by throwing finely divided "dry ice", i. e., solid carbon dioxide, from an aeroplane on the clouds. Similar experiments had been tried previously by various scientists using powedered kaolin, but had not given satisfactory results. Prof. Veraat rose to a height of 2, 500 metres in an aeroplane carrying 1½ tons of "dry ice" and fitted with a special spreading apparatus; he then let the powder fall on the clouds 200 metres below. Abundant rain immediately fell. The experiment was officially controlled by observers in four military aeroplanes.

Prof. Veraat explains the formation of rain by supposing that during the fall from the aeroplane to the clouds the particles of solid carbon dioxide become electrically charged and transformed into microscopic drops of liquid carbon dioxide, which caused condensation in the clouds and consequently a fall of rain. According to Prof. Veraat this method will also make it possible to ensure fine weather when desired. By converting the clouds into rain early in the day he holds that a clear sky may be assured in a given locality for the rest of the day.

(*The Agricultural Gazette* of New South Wales Vol. xliii. Part ii, November 1, 1932).

New Road Material. A new road paint called "Pintar," a composition evolved from the *chir* tree (*Pinus longifolia*), has been invented at the Forest Research Institute at Dehra Dun, in India. It was subjected to a practical test over a stretch of road, and after 6 months' wear and tear it was found that some portions had stood up very well, whilst others had not given such satisfactory service As the result of further laboratory experiments, an improved composition has been evolved, and the cost of manufacture has been reduced without in any way impairing its properties. This improved "Pintar" is being tested. If it proves to be successful and capable of production at the cost which will allow of its competition with proprietary preparations imported for road painting, not only will a market be made available for all the *chir* tar that can be produced, but employment will also be provided for the inhabitants of Kumaun (in Northern India), where the making of *chir* tar is an important local industry.

(*Bulletin of the Imperial Institute*).

Rice in Austria. Experiments in rice-growing have met with success in Central Europe. Good rice in satisfactory quantities is reported to have been yielded by marshy land in Hungary, and it is now intended to open an experimental area for rice cultivation in a nearby district of Austria. During the coming spring rice is to be grown on the borders of the Neusiedlersee Lak, according to an announcement by the Agricultural Chamber of the Burgenland, a district on the border of Austria and Hungary. The slime in this area contains salt, and is therefore expected to prove suitable for the growing of rice.

("*Statesman*" January 20th, 1933).

ABSTRACTS.

Cost of Milk Production at Lyallpur, Punjab. D. P. Johnston and S. Kartar Singh (*Rural section Publication No. 25 of the Board of Economic Enquiry, Punjab, 1932*). With a view to improve the present unsatisfactory state of the milk supply in certain Punjab towns, where the supply was generally unequal to the demand, highly insanitary conditions prevailed, the marketing left much to be desired, and reliable statistics were absent, the authors have conducted an enquiry into the cost of production of milk under Punjab conditions. To ensure reliability of data, the enquiry was conducted at the Agricultural College Dairy Farm at

Lyallpur with a herd of 50 cattle (21 mature cows, one bull and 28 young stock) all of Montgomery breed, completely stall-fed, the cows yielding on the average about 4000 lbs. milk per year. The enquiry extended over a year from 1st April 1930 to 31st March 1931 and the costs of production were analysed under (a) feed, (b) man labour (c) bullock labour (d) buildings (e) equipment, (f) cow cost, (g) bull cost and (h) miscellaneous. The figures showed that :— (1) on the average, the following quantities of food stuffs were required to produce 100 lbs. of milk,—concentrates 60·54 lbs.; green fodder 413·58 lbs.; *bhusa* 31·56 lbs.; salt 1·48 lbs. (2) The total cost per cow including items (a) to (h) above mentioned, amounted to Rs. 272 out of which feed alone represented about 50 per cent, labour came next with 20 per cent and interest and depreciation on cattle came to about 12 per cent. Deducting the value of the calves and manure, the net cost per cow was Rs. 257. (3) The cost of production per 100 lbs. of milk came to about 98·67 annas; or 0·986 annas per lb. for the whole year; but the monthly costs varied considerably from 82·68 annas in February to 148·85 annas in October. This was chiefly due to variations in total production of milk, which ranged from 4,576 lbs. in October to 9,938 lbs. in March; the cost of production of milk varied inversely as the yield per cow. In the Punjab, under natural conditions, cows generally calve between February and May and hence the supply of milk is greater in summer than in winter. The unit proportions of the different items which go to make up the cost of production per 100 lbs. of milk were :— concentrates 60 54 lbs.; green fodder 413·58 lbs.; *bhusa* 31 56 lbs.; salt 1·48 lbs man labour 2·40 days; and bullock labour 0·30 hours. These proportions, being more or less constant irrespective of market fluctuations of prices and rates paid, it is possible to work out the approximate cost of producing milk at any given time by taking current prices, provided of course that the average production of the herd in question is about 4000 lbs. per cow per annum. (C. N.)

Carbon Dioxide Assimilation of the Leaves of the Rice Plant, (Oryza sativa, L)- Dastur, R. H. and Chinoy, J. J. (*Indian Jour. Agri. Sc. 1932, Vol II Part V, pp. 431-454*). The paper presents results of measurement of the photosynthetic activity of the leaves of the rice plant, at different stages of growth of the plant, the activity being measured in two ways viz. (1) by determining the carbohydrate contents of the leaves in the mornings and evenings and by difference, estimating the probable amount of carbohydrates photo-synthesised during the day : and (2) by measuring the rate of absorption of carbon dioxide by the leaves from the air under controlled and uniform conditions of experiment. Both methods gave similar results which indicated that there is at first a sudden rise in photosynthetic activity immediately after transplantation (July 22nd to August 1), after which there is a steady level maintained for about a month. In September there is a temporary depression of activity, followed by a steep rise in October, corresponding to the period of flowering. The maximum is reached in 80—90 days after transplanting, after which there is a continuous fall corresponding to the period of senescence. There are thus two periods of maximum photosynthetic activity, viz., the post-transplantation stage and the stage of flowering. The second maximum is higher than the first; thus at the post-transplantation stage the total carbohydrates, expressed as hexoses, formed 10·75% on the dry weight of leaves, and the amount of carbon-dioxide absorbed per 100 sq. c. m. of leaf area was 0·017 gm., while at the stage of flowering, the total carbohydrates formed 15·2% on the dry matter and carbon-dioxide assimilation per 100 sq. c. m. leaf area was 0·031 gm. Almost all the carbohydrate present in the leaves was in the form of cane sugar, and from observations on the amounts present at different hours of day and night the authors infer that the carbohydrates are translocated from the leaves to the storage tissues in the form of cane sugar. (C. N.)

Nitrogen Recuperation in the Soils of the Bombay Presidency Part III D. L. Sahasrabuddhe and N. V. Kanitar (*Indian Jour. Agri. Sci. 1932, part V, pp. 455—483*). The authors believe that natural nitrogen recuperation (fixation of atmospheric nitrogen by unmanured as well as manured soils) plays an important role in the nitrogen economy of the arid and semi-arid tracts of the Bombay Deccan. In the previous investigations of this series (1925: Mem. Dept. Agri. India, chem. ser. Vol 8. No. 5; and 1931 Indian Jour. Agri. Sci, Vol. 1, p. 631). laboratory pot experiments with different typical soils of the Bombay Presidency, showed definite fixation of nitrogen under favourable conditions of moisture and temperature, and the fixation was increased by additions of lime, phosphatic substances and organic matter. The present experiments report the replication of these experiments on the field scale at the Dry Farm Experiment Station at Manjri near Poona, on clay loam soil of known previous history. Determinations of total nitrogen on composite samples were made once every month from July 1930 till June 1931, (1) in a rectangular unmanured block measuring 3/10 of an acre divided into 12 small bunded areas to prevent run-off of water and kept under careful cultural treatment including frequent harrowing and removal of weeds; one crop of Jowar was grown every year; (2) under the ordinary cultivator's conditions, on 1/10 of an acre divided into four equal plots; the soil was harrowed and stirred a less number of times than in (1) and had a higher density of plant population and also had some weeds; (3) on plots treated as in 1, with this difference that one series of plots in triplicate were kept fallow the previous year, i. e., in 1929, to test the effect of previous fallow on nitrogen recuperation. The rainfall on the area under experiment was mostly precipitated between September and November (13 inches in these 3 months out of a total annual rainfall of about 21 inches); and the maximum air temperature varied from about 26 to 36°C. The effect of manuring on nitrogen recuperation was also studied. The following are among the conclusions arrived at:— (1) The nitrogen content of the soil is not a constant quantity; it fluctuates from month to month, the variations amounting to about 60 to 70 per cent. of the original nitrogen, (2) There is a definite recuperation of nitrogen by the soil both under unmanured and manured conditions, and the recuperation is far more pronounced and continues for a much longer time under field conditions than under laboratory conditions (3) Wetting of the soil by the monsoon rains and the subsequent partial drying and heating during the dry spells of the monsoon seems to be favourable for starting the recuperation process. Moisture, soil temperature and soil aeration, due to the stirring of the soil by harrowing or interculturing, have great influence in changing the nitrogen content of the soil. Addition of organic matter increases also the recuperative power and maintains the nitrogen content at a fairly high level. (4) The maximum peak of nitrogen accumulation is reached in December in unmanured soils and somewhat earlier in manured soils. The maximum is attained at a time when soil moisture is about 20 per cent. and the soil temperature is nearly 30° C. (C. N.)

All India Life Tables. H. P. Choudhuri (*Indian Journal of Med. Research. 1932, vol. 20, pp. 585-598*). The author has compiled and presented in the present paper two sets of Life-tables—one for the Hindu and the other for the Mohomedan male population—with a view to study the mortality rates of these communities in a scientific manner by comparison amongst themselves and with the English people. Previous workers like Baines, Hardy, Auckland, Meikle and others started with the decennial census figures as the basis for their mathematical graduations and actuarial analysis. But the present author considers that the census records are defective and far from satisfactory for mathematical treatment; and has preferred to draw his material from the lives registered with the

Life Insurance Companies, which have been under regular observation and offer satisfactory and accurate material for the construction of a standard Life Table. One draw-back of such a table, however, is that the data are limited only to the well-to-do and literate section of the population, the poor illiterate mass being, as a rule, unable to take advantage of life insurance. As only about 10% of the population of India is literate, the tables presented are not National Life Tables, but Life Tables of a 'Select Class'. From an actuarial analysis of the figures, which are presented in the form of comparative Tables, the author arrives at the following deductions:— (1) The Hindu mortality has decreased in the course of the last 20 years (2) The Mahomadan mortality is lighter than the Hindus, taking the average for all India. It is heavier up to age 15, in the Punjab and Madras, and up to age 30 in Bengal; it is lighter at all ages in Bombay and United Provinces, from 30 years upwards in Bengal and from 15 years upwards in the Punjab and Madras. The difference however, is only of small magnitude eg. the graduated All-India ratio of probability of living of Mahomedans with that of Hindus, is at age 10, 0·9964; at age 20, 0·9990; at age 30, 1·0005; at age 40, 1·0018; at age 50, 1·0037; at age 60, 1·0060; at age 70, 1·0087; at age 80, 1·0118 etc. (3) The All India Hindu mortality at any age corresponds to the English mortality at an age nine years in excess. (4) In expectation of life, an Indian life is 7 years shorter than that of an Englishman (between ages 20 and 95). (5) One-fourth of the children die before the age of 1 year, and half the population die within the age of 25 years. (6) Average expectation of life at birth is about 30 years. (C. N)

Drought resistance in relation to the physiology of the Rice plant. J. Onodera (*Proc. Crop Sci. Soc. Japan, 1931: vol. 3 pp. 91—116*). The author has studied the factors underlying drought resistance from the standpoint of rice cultivation and breeding, with special reference to the differences between low-land rice and upland rice varieties. He considers that in the rice plant, the influence of drought is most marked on yields and heights of culm, and hence ratios of yields and heights of culms are good indications of drought resistance. More than one hundred varieties of rice were compared in low-land and upland conditions for 4 years since 1923; characters investigated were, the height of culm, mean weight of panicles, the development of stereome or mechanical tissue in leaves, the osmotic pressure of the cell sap and the transpiration coefficient or water requirement. The data showed:— (1) The up-land rice was not so much influenced by scanty water supply as low-land rice The ratios of height of culm were longer in upland rice than in low-land rice. (2) The mean weight of panicles of the plants grown with soil moistures of 5, 10, 15 and 20 per cent., showed a distinct difference between up-land and low-land varieties. The decrease of mean weight of panicles owing to the droughty conditions was not so much in up-land rice as in low-land rice. (3) The difference of development of the stereomes in leaf-blades was distinctive of the degree of soil moisture; the less the soil-moisture content, the more the stereomes developed (4) Changes in osmotic pressure of cell sap and of pressed plant juice seemed to be characterised differently in up-land and low-land varieties. Upland rice was not so sensible to a slight decrease of soil moisture in the moistened state, but in the limiting dryness showed remarkable elevation. Low-land rice however, was more sensible to slight decreases of soil-moisture in the moistened state, but at the stage of limiting dryness did not show any remarkable elevation. (5) Cryoscopic determinations of the osmotic pressure of the cell-sap, showed no relation between osmotic pressure and drought resistance. (6) The difference in transpiration coefficients or water requirements between upland and low land varieties, was not statistically significant; the water requirement of upland rice, however, tended to be somewhat lower than that of lowland rice. In both cases, the water requirement was increased by decrease of soil moisture. (7) In regard to yields per plant in upland and lowland conditions the yields of upland rice were not so much influenced by soil moisture as those of lowland rice, just as in the height of culms. The ratios of yields of upland varieties were larger than those of lowland varieties. (8) The correlation between ratios of yields in the two different conditions and ratios of height of culm in the two different conditions was very distinctive. Correlation coefficient r was $+0.7313 \pm 0.03576$, and this value indicates that there is close correlation. The author therefore infers that ratios of yields and heights of culms are good indications of drought resistance. (C. N.)

Reviews.

The Open Pan System of White Sugar Manufacture. By R. C. Srivastava (Government of India Central Publication Branch, Calcutta, 1932, Price Rs. 3-2-0 or 5 sh. 6 d) This timely publication from the pen of R. C. Srivastava, Sugar Technologist to the Imperial Council of Agricultural Research, India, reports a comparative study of two of the popular indigenous (Khandsari) systems of white sugar manufacture in India, viz., the Rohilkhand and the Bhopal Bel systems. The sugar industry in India has, of late, been much in the fore-ground of public attention, and, acting on the recommendations of the Indian Tariff Board, the Government of India have adopted a strong protective tariff policy, in regard to sugar imports, with a view to develop and encourage local manufacture. Though India grows nearly 35·2 million tons of cane, most of it (25·5 million tons) is used in the manufacture of *Gur*, and only a small proportion (about 4·5 million tons) is utilised in the manufacture of white sugar by *Khandsaris* and factories combined. The amount of white sugar produced locally is about 320,000 tons, while the imports amount to over a million tons per year, mostly from Java. Of the 4·5 million tons of cane utilised for white-sugar manufacture, about 3·8 million tons are dealt with by *Khandsaris* (*bel* processes), and only about 0·75 million tons in sugar factories. The efficiency of the factories is undoubtedly high, as shown by the fact that for the small amount of cane handled by them, they have shown a production of 120,000 tons of white sugar, while the *Khandsaris* (bel processes) with their much larger utilization of cane, have produced only about 200,000 tons of white sugar. But for several reasons, including the lack of organised capital, the scattered nature of the sugar cane areas, the inevitable delay in setting up large-scale machinery etc., the number of factories manufacturing white sugar in India, has not shown, in spite of the impetus given by protective tariff, the desired increase during the last few years. It is true that the number has risen from 18 in 1919 to about 30 in 1930 and as many as 20 new factories are in course of construction; but even allowing for a more rapid increase in the number of factories in the next decade, the total capacity of the factories for white sugar production may hardly aggregate to more than about 300,000 tons per year as against the imports of a million tons which may show an increase hereafter, with increasing sugar consumption in the country. As such, the Imperial Council of Agricultural Research have rightly felt that attention could profitably be devoted also to the encouragement and improvement of the local Khandsari (bel) system, which produces even today more white sugar than all the factories put together, and where, on account of the lower capital involved and the small scale of enterprise, a much more rapid increase of production can be expected and practical improvement obtained early enough to render India self-contained in the matter of sugar, within the fifteen year limit proposed by the Imperial Council.

Mr. Srivastava's study of the indigenous *bel* systems, reported in the present publication, though of a preliminary character and extending over a few months only, has served to show the imperfect nature of even the best of the local systems, like the Rohilkhand and the Bhopal methods, and the great scope for improvement that exists in both these methods. It is of course, not possible within a few months' trial, to suggest workable improvements or radical modifications the incorporation of which may be necessary before the efficiency of the indigenous system can be raised to enable it to compete with factory production. The author has rightly pointed out the necessity for opening a Central *Bel* Research Station in the cane-belt area of Northern India for carrying on a sustained study of the local systems and for obtaining the technical data necessary for improving the plant and process on scientific lines.

As conditions prevail at present, the *bel* system of white sugar manufacture is sorely lacking in efficiency in all its aspects—in the percentage extraction of juice which amounts to only about 60% as compared with 85 to 90% in factories and also in the recovery of the sucrose present in the expressed juice, which amounts to about 50 to 60% as against the 90% obtained in factories. The net result is that only about 6 to 6·5% of the sucrose, present in the cane, is finally recoverd as white sugar even in the best of the *bel* processes, while the average recovery in factories is about 10%. A serious draw-back of the *bel* system which may require early attention, is that during evaporation and concentration the purity of the juice falls from 86% to about 80%, indicating considerable inversion which adversely affects recovery and quality in later stages, while in factories there is always a rise of purity from juice to syrup and massecuite.

The author has, as the result of his comparative studies, given drawings of an improved type of *bel*, which combines several advantages of the present methods, with additional improvements like increased fuel efficiency secured by the provision of a fire-grate, decrease in the number of boiling pans etc, but his suggestions still remain to be tested under actual working conditions. It should be possible, with the help of technical investigations concentrated at a Central Research Station, as suggested by the author, soon to evolve a simple type of plant, combining the open pan and vacuum processes and employing liming and sulphitation, which could be run on a small capital and at the same time be able to produce at competitive prices sugar of better quality than the present average *Khandsari* sugar.
C. N.

Bibliography of Tropical Agriculture (International Institute of Agriculture, Rome, price 10 Liras)· The International Institute of Agriculture, Rome, has added one more to its list of publications by starting this Bibliography. Until 1930 this bibliography used to appear in the monthly Bulletin of Technical Information of the International Review of Agriculture under the head "documentation". It has been possible to undertake this publication by a donation from the President of the Institute; but its continuance will depend upon its sale sufficient to cover the cost.

The Bibliography deals with all technical publications on crops grown in the tropics. The crops are first classified as Starch and Sugar plants which include all cereals ; Oil yielding plants ; Beverage plants including coffee, tea, cocoa etc.; Industrial crops; Vegetables; Fruits ; Forage crops ; Spices ; Medicinal plants etc. Under each of the crops dealt with the subjects are classified according to the alphabetical order of the authors, giving in the form of a short abstract the salient feature of each of the publications. The book will form a highly useful reference to all those interested or engaged in Tropical Agriculture and should find a place in all the Agricultural Institutions of the Tropics.
K. R.

Crop and Trade Reports.

Sugarcane Crop Report, Madras, 1932, Third or Final Report. On an average of the five years ending 1930–31, the area under sugarcane in the Madras Presidency has represented 3·6 per cent of the total area under sugarcane in India. The figures in this report relate to the sugarcane crop sown in 1932. (Estimates up to the 25th December 1932.) (1) The area planted with sugarcane is estimated at 125,220 acres as against 116,530 acres, the estimate for the previous year. This represents an increase of about 7·5 per cent. The estimate for the previous year was in excess of the final area of 116,105 acres by about 0·4 per cent. (2) The present estimate of area exceeds the second forecast by 8,120 acres. The excess occurs mainly in Vizagapatam, Chittoor, Salem and Coimbatore. (3) The increase in area over the final forecast of 1931 occurs in all districts outside East Godavari, the Deccan, Madura and Ramnad. (4) The harvest has just commenced. Normal yields are expected in all districts outside Kurnool, Chingleput, South Arcot, Trichinopoly, and the South (Tinnevelly excepted), where the yield is expected to be below normal. The crop was affected by heavy rains in Chingleput, South Arcot and Madura. The seasonal factor is calculated at 98 per cent of the average as against 97 per cent in the previous year. On this basis, the yield is estimated at 345,930 tons of jaggery as against 319,430 tons estimated in January 1931. The final estimate for 1931-32 was 323,630 tons. (5) The wholesale price of jaggery per candy of 500 lb. is reported to vary from Rs. 24 to 33. *(From the Board of Revenue, Madras).*

Pepper Crop Final Report, Madras, 1932 (1) The area under pepper in 1932 is estimated at 80,000 acres in Malabar and 7,700 acres in South Kanara against 83,409 acres in Malabar and 7,534 acres in South Kanara in the previous year. (2) The crop in Malabar was affected to some extent by the "Pollu" disease owing to excessive rains in October and November 1932. (3) The seasonal factor is estimated to be 95 per cent in Malabar and normal in South Kanara. On this basis, the yield is expected to be 11,400 tons for Malabar and 1,200 tons for South Kanara or 12,690 tons for the West Coast. This is the same as in the previous year. (4) The present price of pepper varies from Rs. 117 to 125 per candy of 500 lb. against Rs. 160 reported in August 1932. *(From the Board of Revenue, Madras)*

Ginger Crop Final Report Madras 1932. (1) The area under ginger in 1932 is estimated at 10,300 acres in Malabar against 10,635 acres in the previous year. (2) The seasonal factor is estimated to be normal and the crop is expected to yield 3,700 tons of dry ginger against 3,900 tons in the previous year. (3) The price of dry ginger varies from Rs. 34 to 38 per candy of 500 lbs. *(From the Board of Revenue, Madras).*

Ground-nut Crop Report, Madras, 1932, Fourth or Final Report. On an average of the five years ending 1930—31 the area under ground-nut in the Madras Presidency has represented 53·7 per cent of the total area under ground-nut in India. The figures in this report relate to the ground-nut crop sown between January and December 1932. (Estimates up to the 25th December 1932). (1) The area under ground-nut in the Madras Presidency in 1932 is estimated at 3,494,100 acres as against the estimate of 2,707,500 for the previous year. This was in excess of the finally recorded area of 2,635,427 acres by 2·7 per cent. The average area is 3,068,100 acres. (2) The area in 1932 was greater than that in 1931 by 32·6 per cent. The increase was general outside East Godavari, South Arcot, and Malabar and it was due to the rise in price at sowing time. The increase was marked in the Deccan, where the area rose from 1,064,800 acres to 1,559,000 acres. (3) The harvesting of the summer and early crop of ground-nut was finished by October. The harvesting of the winter or main crop is proceeding. (4) The crop was normal only in the Circars, Coimbatore, the South (Tanjore excepted), and Malabar. The crop was affected by caterpillars in parts of Salem. In the other districts, the crop was to some extent affected by drought during the growing period. In South Arcot, the yield is expected to be specially low, about 75 per cent. of the average. The seasonal factor for the Presidency works out to 93 per cent of the average against 94 per cent. in the previous year. On this basis, the yield is estimated at 1,631,200 tons of unshelled nuts against 1,234,250 tons in the previous year an increase of 32 per cent The yield in an average year is estimated at 1,534,050 tons. (5) The wholesale price of ground-nut, unshelled per candy of 500 lb. is reported to vary from Rs. 20 to 25 in Chittoor and North Arcot and Rs. 15 to 20 in the other districts. As compared with the rates reported in November, the price was stationary in Chingleput, rose in Bellary, Anantapur Chittoor, Salem, Coimbatore and Tinnevelly and fell in the other districts. (*From the Board of Revenue, Madras*).

Gingelly Crop Third Report, Madas, 1932-33. On an average of the five, years ending 1930-31, the area under gingelly in the Madras Presidency has represented 12·5 per cent of the total area under gingelly in India. The figures in this report relate to the gingelly crop sown between April and December 1932. (Estimates up to the 25th December 1932). (1) The area sown with gingelly up to the end of December 1932 is estimated at 634 500 acres as against the estimate of 541,900 acres made for the corresponding period of last year. This shows an increase of about 17 per cent. (2) The increase in area is general in the main tracts in which the crop is grown It is marked in the Central districts where the area has risen from 153,700 acres to 201,500 acres. (3) The main crop has been harvested except in Trichinopoly and the South. The yield is reported to be normal except in Ganjam, Vizagapatam, South Arcot, Chittoor, North Arcot and Tanjore. (4) The seasonal factor for the Presidency works out to 98 per cent of the average against 97 per cent for the corresponding period of last year. On this basis, the yield is estimated at 83,600 tons as against 70,900 tons for the corresponding period of last year. (5) Gingelly which was selling at 10 to 13 lb. per rupee in November 1932 has slightly fallen in price, the present rates varying from 10 to 15 lb. in most districts. (*From the Board of Revenue, Madras*).

EXTRACTS FROM THE SEASON AND CROP REPORT OF THE MADRAS PRESIDENCY FOR 1931-32 (Fasli 1341).

1. **Classification of area.**—The total area of the Presidency was 91,148,210 acres or 119,330 acres more than in the previous year. This is mainly due to the large difference in Kurnool and to smaller differences in Bellary, Anantapur, Coimbatore, Madura, and Malabar. The matter is under correspondence. Forests constituted 14·6 per cent in the year under review and the area not available for cultivation was 22·5 per cent. The area available for cultivation was 57,299,433 acres of which 19 per cent was fallow, 23 per cent was other cultivable waste, and the rest (58 per cent) was cultivated, viz., 33,495,798 acres. The area cultivated was 36·8 per cent of the total area for the Presidency. The cultivation was the highest in Bellary being 66 per cent and was between 50 and 60 per cent in the districts of West Godávari, Guntur, and Tanjore.

2. **Area irrigated.**—Of the area under cultivation referred to above, 27·5 per cent, viz., 9,204,063 acres was irrigated. This area was 50 per cent and more in the deltas of East Godavari (57), West Godavari (82), Tanjore (73), and in the non-delta, Chingleput (61). Of the total area irrigated, Government canals served 40·5 per cent, private channels 1·6, tanks (Government and private) 37·5, wells 14·6, and other sources as spring channels 5·8 per cent. Besides, wells supplemented other irrigation sources to the extent of 3·6 per cent. Government canals were important in all the deltaic districts, private channels in Ganjam, Vizagapatam,

and East Godavari, tanks in Chingleput (91 per cent). Ramnad (85), North Arcot (70), Chittoor (64), Ganjam (64), Tinnevelly (63), South Arcot (58), and Vizagapatam (55); wells in Coimbatore (79 per cent) and Salem (46), and other sources as spring channels in Ganjam, Vizagapatam, East Godavari, Cuddapah, and Nellore. Canals, tanks, and wells are almost equally important in Madura. Though there are no recognized sources of irrigation on the West Coast, there is some irrigation from *porámboke* channels and streams, but figures showing the extent so irrigated are not available.

3. **Crops irrigated.**—The area of crops cultivated was 38,344,577 acres and it exceeded the area of land under cultivation by 4,848,779 acres. The difference is due to the fact that on some lands more than one crop was raised. 29 per cent (viz., 11,184,258 acres) of the area of crops cultivated was irrigated. The percentage of the area of irrigated crops exceeded 50—in Chingleput (68), Tanjore (70), and West Godavari (69). The percentage of irrigated area was the smallest in Salem (17), Guntur (16), Anantapur (10), Kurnool (5), and Bellary (3). Out of the area of crops irrigated, cereals and pulses contributed 90 per cent, oil-seeds (groundnut, gingelly and castor) 2 per cent, and sugarcane 1 per cent. Seventy-two per cent of the extent under paddy was irrigated. The corresponding percentage for other crops irrigated were 43 (ragi), 27 (indigo), 12 (gingelly), 11 (cumbu), 9 (cholam and cotton, mainly Cambodia), and 3 (summer groundnut). The areas under irrigated ragi and indigo were among the lowest reported. Sugarcane was irrigated everywhere except on the West Coast, where it was mainly rain-fed.

4. **Area sown with Crops.**—(38,344,577 acres). Food crops occupied 79 per cent of the total area sown in the Presidency against 78 per cent in the last year and the percentage was the highest reported since 1922-23. Cereals occupied 66 per cent of the total area. The area under non-food crops, mainly groundnut, has been decreasing since 1928-29. Excluding the Nilgiris, the area under food crops was the lowest, ranging from 60 to 70 per cent, in Kurnool, Bellary, and Tinnevelly and the highest, ranging from 83 to 93 per cent, in the Circars (Guntur excepted), Nellore, Chingleput, Chittoor, Salem, Trichinopoly, Tanjore, Madura and South Kanara. Paddy occupied 30 per cent, cholam 13, cumbu 8, groundnut 7, ragi and cotton 6, kora 4, gingelly 2, castor, coconut, and tobacco 1. The area under paddy, blackgram, greengram, condiments and spices, and fruits and vegetables (plantains and mangoes) was the highest or among the highest reported, while the area under cumbu, ragi, samai, and maize, was among the lowest reported. Of the non-food crops, the area under tobacco, tea and fodder crops was the highest or among the highest reported while the area under castor, coconut, and indigo was the lowest or among the lowest reported. The area cultivated with crops was restricted in Ganjam, Anantapur, Cuddapah, South Arcot, the Central districts and the South (Ramnad excepted). The reduction was marked in Coimbatore (-99,656 acres).

5. **Main Crops.**— Marked variations in the area under main crops are noted below:— **Paddy.** (Average 11,169,600 acres; current 11, 537,753 acres).—The increase in area was general outside Ganjam, Vizagapatam, Bellary, Anantapur, Tanjore, Tinnevelly and Malabar. The increase was greatest in Chittoor, North Arcot, and Ramnad. **Cholam.** (Average 4,843,270; current 4,830,678).—There was a large increase in area in Anantapur and Salem and a large reduction in area in Tinnevelly. **Cumbu.** (Average 3,088,100; current 2,877,161).—The area was restricted in all districts outside the Circars, Cuddapah, and Chingleput. The reduction in area was marked in Coimbatore (—89,705 acres). **Ragi.** (Average 2,293,700; current 2,200,674).—There was a reduction in area in all districts outside Vizagapatam, West Godavari, Kistna, Salem, Coimbatore, Trichinopoly, and the West Coast. **Korra.** (Average 1,519,390; current 1,428,839).—This crop occurs mainly in Guntur,

and the Deccan. There was an increase in area in Kurnool and a reduction in other districts. **Varagu.** (Average 1,089,500; current 1,118,182).—The area showed an increase in all the districts outside Ganjam, Vizagapatam, Anantapur, Nellore, Chingleput, Coimbatore, and the South. **Samai.** (Average 803,720; current 746,833).—There was an increase in area in Vizagapatam, East Godavari, West Godavari, Cuddapah, Salem, Coimbatore, Trichinopoly, and Tinnevelly and a reduction in most of the other districts. **Maize.** (Average 136,470; current 110,184).- This crop is important in Guntur, Kistna, and Vizagapatam. There was a reduction in area in the first two districts. **Pulses.** (Average 2,880,330; current 3,140,112).- There was an increase in area outside East Godavari, Chingleput, Chittoor, North Arcot, Trichinopoly, and Madura. There was an increase in area under all the pulses except redgram. **Chillies.** (Average 283,750; current 330,929).—The increase was almost general. **Sugarcane.** (Average 100,900; current 116,105).—The increase occurred in all the districts outside Vizagapatam, Kistna, Trichinopoly, and the West Coast. **Groundnut.** (Average 3,068,100; current 2,635,427).—There was an increase in area in Vizagapatam, Kistna, Guntur, Bellary, Anantapur, Ramnad, and Tinnevelly and a reduction in other districts, especially in Chingleput, South Arcot, and the Central districts. **Gingelly.** (Average 799,630; current 747,053).—The area was restricted in all the districts outside Vizagapatam, Bellary, Anantapur, Chingleput, Chittoor, Trichinopoly, and Ramnad. **Castor.** (Average 327,140; current 330,106). **Cotton.** (Average 2,411,670; current 2,204,506).—The reduction in area was general outside Bellary and was due mainly to the fall in price. **Indigo.** (Average 49,720; current 37,239). **Tobacco.** (Average 270,550; current 268,815).

6. **Trade.** The volume of trade in the year under review was less than that in the previous year. Exports declined from 43·03 crores to 35·5 crores and imports from 44·39 crores to 35·49 crores. The decline was due mainly to world trade depression and fall in prices and partly to the political situation. The general level in the rates of import duty rose from 15 per cent. to 25 per cent. at the end of September 1931.

Foreign Imports. Imports of rice and paddy amounted to 23,935 tons from Indo-China, and 2,292 tons from Siam. Imports of leaf tobacco from the United States of America rose from 11·05 lakhs of lb., to 14·95 lakhs of lb. There was a great fall in imports of cigarettes owing to local manufactures. Imports of sugar declined from 88,296 tons to 79,120 tons; a noteworthy and new source of supply was Southern Russia which supplied 5,113 tons. The imports of rice and flour machinery fell from 2·98 lakhs to 1·86 lakhs and agricultural machinery from 1·09 lakhs to 0·62 lakh while imports of sugar machinery rose from 0·13 lakh to 1·03 lakhs. Two thousand four hundred and twenty-two tons of raw cotton were imported from America. Imports of cotton twist and yarn fell from 7 million lb. to 6·6 millions; China was the main supplier of grey yarn while United Kingdom held the predominant position in other varieties. Imports of manures fell from Rs. 32·48 lakhs to Rs. 15·93 lakhs chiefly due to the reduced purchasing power of the ryots. Imports of soaps mainly from the United Kingdom fell from Rs. 23·11 lakhs to Rs. 15·52 lakhs; three-quarters of the quantity imported being "household and laundry" and the rest toilet soap.

Foreign Exports. Shipments of groundnuts increased by 8 per cent in quantity; nearly half was exported from the Madras Port. Exports of raw cotton fell from 21,167 tons to 12,264 tons due to the increased demand by the Indian mills for Madras cottons. Belgium took the largest quantity (4,541 tons) followed by China (1,934 tons), France (1,424 tons), and Japan (1,382 tons). The exports of pepper and chillies were slightly greater than in the previous year in quantity, but the value was less. Ceylon practically consumed all the chillies. Ceylon imported 2,354 tons of paddy and 56.587 tons of rice as against 4,368 tons of paddy and 101,659 tons of rice in the previous year. The United Kingdom was the principal consumer of tea to the extent of Rs. 368·02 lakhs Exports of coffee declined from Rs. 188·35 lakhs to Rs. 92·92 lakhs due to very poor harvest and over-stock in foreign markets as a result of very large shipments in the previous year; France was the best customer closely followed by the United Kingdom. Exports of oil-cakes mainly to Ceylon increased from 21·31 lakhs to 26·82 lakhs; Ceylon was the sole importer of gingelly cakes to the extent of 11,806 tons. There was a decline in the exports of tobacco by 9 per cent in quantity and 12 per cent in value; the United Kingdom was the chief consumer of raw tobacco. Shipments of castor fell from 41,279 tons to 33,407 tons. Exports of rubber declined from Rs. 99·71 lakhs to Rs. 29·91 lakhs due to the abnormal fall in prices; the United Kingdom and Ceylon were the chief buyers of raw rubber.

A SHORT ACCOUNT OF THE TOUR OF CLASS II STUDENTS OF THE AGRICULTURAL COLLEGE, COIMBATORE.

BY C. BALASUBRAMANIAN, *Student, Class II.*

The second year students left on the 4th January on a tour to the Ceded Districts, accompanied by Messrs. H Shiva Rao, B. Sc., E. K. Nambiar, L. Ag., and M. Satyanarayana, B. A., B. Sc. Ag. The route chosen being through Bangalore. advantage was taken of a day's stay there to visit the "Indian Institute of Science" and the "Hebbal School" and the Farm attached to the latter. At the Institute, Dr. Subramaniam, Professor of Bio-Chemistry very kindly explained the methods of disposal of sewage, activiated sludge process and septic tank process, obtaining at the Institute. At the Hebbal Farm, Dr. V. K. Badami, L. Ag, Ph. D. showed us round the newly started Serum Institute, the manurial, cultural, varietal and other experiments on paddy and sugarcane conducted on the farm, and the sheep-run where experiments are in progress to improve the quality and quantity of wool produced.

Three delightful days were spent at the next halt Hagari—where Mr. C. Vijayaraghavan, Farm Manager, led us round the farm and explained the numerous experiments including the newly started experiments on 'Conservation of soil moisture' in a very lucid manner. The museum attached to the Research Station with its interesting collection of Ceded Districts implements, renowned and very efficient, at the same time very simple and indigenous, afforded an instructive study. Yet another interesting day was spent at Hagari in the company of Mr. K. Sanjiva Shetty, Agricultural Demonstrator. in visiting the neighbouring villages, where we learnt the methods of cultivation of paddy in wet lands adopted by the villagers. We elicited from a representative ryot. statistical information about the economics of the Ceded District ryot.

At Hospet Mr. T. Krishna Reddi, the Agricultural Demonstrator, gave us all the particulars about the cultivation of oranges, lime, mango, and grapevine and the work he had done in that direction advocating to local ryots such methods as root-pruning for grape-vine and shoot-pruning for citrus. We were led by Mr. Reddi to certain extremely alkaline patches of land and were given an exhaustive and clear idea of the methods adopted for reclamation of alkali lands. The party then visited the farm house of Mr. A. Ranganatha Mudaliar, (Ex-Development Minister) who has given practical evidence of his keen interest in agricultural and horticultural practices by maintaining a good fruit garden himself.

On 10th Januury the party proceeded to Hampi to see the old irrigation works and also to learn about the method of cultivation of sugarcane adopted by ryots there, and incidentally availed of the opportunity to visit also the ruins of the old Vijayanagar kingdom.

Leaving Hospet on 11th January and passing through Bangalore on 12th, Hosur was the place of next visit. Here the students saw the different breeds of sheep, cattle and pigs and acquainted themselves with several varieties of useful fodder grasses grown on the pastures.

The party visited the "Imperial Institute of Dairying and Animal Nutrition," Bangalore, the next day, where pasteurisation of milk was demonstrated. The students also acquainted themselves with the breeding experiments in progress wherein wild breeds from Kathiawar are attempted to be domesticated and turned to lucrative purposes.

At the Lal Bagh gardens, Mr. M. K. Sitarama Chetti, the Assistant Superintendent, demonstrated to the party the method of propagation of roses by budding, and of apples by grafting and showed some rare specimens of the gardens such as "Queen-Pine," many scented plants, etc. He also showed an uncommon tree known as '*Ficus kistna*' the leaf of which is cup-shaped and laid stress upon the fact that in the whole of India only two or three such trees are found and that much religious significance is attached to them. He explained very clearly the methods of fruit preservation pointing out that the process is easy and does not involve much capital expenditure and therefore could be tried by several people both as a hobby and also as a commercial enterprise.

The party wound up the stay at Bangalore by playing a hockey match against the Central College. We ungrudgingly acknowledge our defeat by a big margin of 7 goals in nine as they were certainly much superior to us.

In conclusion we offer our heart-felt thanks and gratitude to all those gentlemen, who rendered us great help and enabled us to bring the tour to a successful termination.

College News and Notes.

The Victory Cup. The annual interclass tournament in hockey, football and cricket provided more than passing interest. In hockey, class II were the favourites, but class I by clever team work defeated them and subsequently registered another win over class III to whose credit it may be said that despite the absence of some of their regulars, they put up a strenuous fight. In cricket, class I fielded what was on paper the strongest team but were fully extended by class III for whom Varadarajan played a great game both with bat and ball. Class I were expected to have an easy walk over class II and annex the cup. However, their encounter proved most interesting and at times thrilling in that class II sprang a great surprise on their stronger rivals by dismissing them for 31 runs and in their turn making a paltry lead of 4 runs on the first innings. Class I woke up too late and though their opening batsmen easily registered a century without loss and declared, try as they might they could not run through their opponents' side within time. Ananda was the hero of the day, for besides being deadly with the ball in the first innings, he virtually carried his side on his shoulders was top scorer in both innings. Class II narrowly managed to beat the clock and avenged their defeat in hockey. In football, class III upheld their reputation and won convincingly over the other two classes. Thus for the first time in the history of this tournament the honours were even.

Krishnamurthi Rao Memorial Tournament. The intertutorial hockey tournament run on the league system was keenly contested and was eventually won by Mr. P. V. Ramiah's Wards.

Olympics. Our College was represented at the Coimbatore Olympic Sports recently organised by the Coimbatore Athletic Association and which is open to institutions as well as private individuals in the districts of Coimbatore, Salem, Nilgiris, Malabar and S. Kanara. Student Bennet Massilamony of class II won the individual championship medal for the best all round athlete by snatching first places in Pole vault and Javelin throw and the second place in 100 yards dash.

Indian Officers' Association. The Agricultural section of the I. O. A. entertained Rao Bahadur C. Tadulingam at a garden party held in the Botanical Garden in honour of the title recently conferred on him.

Our Flying Director. The Agricultural colony was delighted to hear the news that our popular Director, Mr. S. V. Ramamurti, I. C. S. recently made a *flying visit* to Hosur on an inspection tour and returned to Madras by air, this being the first instance of any officer in the Province and perhaps in the whole of India to travel by air on official tours.

Students' Club. Under the auspices of the Students' Club, Mr. K. S. Vydhyanatha Iyer, Professor of English at the Victoria College, Palghat, delivered an address to the students and staff on " The saving grace of your profession ".

A games tour. Following the lead of the College cricket team, a combined team of hockey, soccer and tennis players went on a weekend tour during February and played a series of matches at Calicut. In hockey, our team drew with the Bharat eleven but lost to St. Joseph's European High School by one goal. In football we met the Malabar Christian College, the strongest combination in Calicut, and lost by one goal, but in tennis, we won both doubles and singles matches against the same institution. The tour was thoroughly enjoyed and it is hoped that the precedent set up this year will be followed in the future.

Research Council. It is understood that at the instance of the Director of Agriculture, a Research Council consisting of the heads of research sections in the Institute was formed recently. At a meeting of the Council Dr. T. V. Ramakrishna Ayyar and K. Ramiah were elected President and Secretary respectively. The function of the Council appears to be to discuss the programme of work of the various sections and to co-ordinate the research done at the Institute.

Poona Agricultural College Commission. On the invitation of the Bombay University Rao Bahadur C. Tadulingam visited the Poona Agricultural College as a member of the University Commission of Inspection.

Visitors. Among distinguished visitors who came to the College recently were the Raja of Kangundi and Mr. Francis, Cane Farm Superintendent of Messrs. Parry & Co., Nellikuppam.

The Association of Economic Biologists, Coimbatore. The annual meeting of the association came off on 17th January afternoon. After the usual tea and group photograph the members adjourned for the business meeting. The annual report presented to the general body showed an all round progress, first in the increased strength of the members and secondly under finance there being a net balance of nearly Rs. 200. The question of the association publishing its proceedings either on its own separately or in the Madras Agricultural Journal was discussed and for want of time it was decided to continue the discussion at a special meeting to be convened later for the purpose. The following members were then elected for the various offices for 1933.

President. Mr. G. N. Rangaswamy Ayyangar. *Vice-President.* Mr N. L. Dutt. *Secretary,* Mr. K. Ramiah. *Committee members.* Rao Bahadur T. S. Venkatraman and Dr. T. V. Ramakrishna Ayyar. Mr. M. A. Sankarier was re-elected the auditor for 1933.

Later in the evening Mr. S. Sundararaman, the retiring president gave his address on " The Progress of Mycological Research in Madras ". In the address which was illustrated by slides, he gave a brief outline of the several investigations that had been undertaken and solved successfully by the mycological section. He cited as instances the following diseases, Budrot in palmyra, *Koleroga* in arecanut, Red rot in sugarcane, mildew in grape vines, bleeding disease in coconut palm, Smuts on Cholam etc. He also gave details about the investigations that were in progress on *piricularia* in rice, mosaic disease in sugarcane etc. He finally stressed the importance of plant pathology to crop-breeders and the necessity for the evolution of disease resistant forms of crops as the damage caused to crops by some of the diseases was often several times greater than the degree of improvement sought to be obtained by breeders by selection and breeding alone.

With a vote of thanks to Mr. Sundararaman proposed by the President the meeting terminated.

The fieldmen Association of the Madras Agricultural Department. At a General Body Meeting of the above Association—which was founded in the year 1930, for promoting the welfare of the Fieldmen of the Madras Agricultural Department,—the following executive was formed for the current year:—*President:* Dr. J. S. Patel. Oil Seeds Specialist. *Secretary:* S. Srinivasan, Fieldman, Millet Section. *Assistant Secretary & Treasurer:* K. Raghavan, Fieldman, Indian Central Cotton Committee and a Committee of four members.

The Association takes this opportunity to thank Dr. J. S. Patel for accepting to be its President.

On 8—1 1933, the Association was 'At Home' to M.R.Ry. Rao Bahadur C. Tadulingam Mudaliar, Avl., to express its felicitation on the conferment of the New year honour on him.

The Secretary appeals to all mofussil fieldmen, who have not yet joined the Association, to remember the proverb 'Union is Strength' and to enroll themselves as members as early as possible. He will also be glad to receive any suggestion or proposals regarding the Association

An Appeal to Sympathisers.

Mr. K. T. Alwa writes: The unexpected and sad news of the death of late Mr. M. K. Nambiar, Asst Director of Agriculture, Madura, has caused considerable sorrow among his friends and admirers. It is the desire of some of his friends that the memory of such a noble soul should be kept alive and they have written to me that I should appeal to you on their behalf for support. Being in close touch with the late Mr. Nambiar for nearly 25 years as a class-mate, co-worker and a friend, I undertake this as my bounden duty with the full hope that you associate yourself with this humble yet noble cause of showing our appreciation of the good qualities of a man who is no more with us today, but his simplicity, honesty, nobility, sincerity, ability to guide juniors and capacity to follow the superiors are characters which he has left behind. His fragile constitution was no hindrance for hard work stimulated with the burning desire to do his utmost in whatever position he was placed. The greater part of his service was spent at Taliparamba in working up the Agricultural Middle School which unfortunately did not survive the experimental stage, but records and surroundings of the school will reveal his labours. Though of a shy disposition with inherent dislike for lime-light, yet he was a loving friend, kind master and a faithful subordinate on whom one could rely for sound advice, able guidance, and devoted service. He was a man of clear thinking and was clean in his thoughts and deeds. Such a man had a premature and sorrowful death, away from his home without the tender look and nursing of his loving family and friends. He stood for duty and died for it.

Sir, now it is our duty to show our appreciation of his good qualities by contributing our mite to the humble memorial we have in veiw. If you are in sympathy with our humble effort, please send your contribution to Mr. E. K. Govindan Nambiar, Agricultural Demonstrator, Tellicherry, who will thankfully acknowledge the amount.

Weather Review.

Weather Report for the Research Institute Observatory :

January 1933 Report No. 1 33.

Absolute maximum in shade	89·5
Absolute minimum in shade	58·5
Mean maximum in shade	85·6
Departure from normal	- 0·5
Mean minimum in shade	63·7
Departure from normal	- 0·9
Total rainfall in month	nil.
Departure from normal	- 0·84″
Mean daily wind velocity	2·00 M. P. H.
Mean 8 hours wind velocity	3·00 M. P. H.
Mean humidity at 8 hrs.	71·6 %
Total hours of bright sunshine	254·5
Mean daily hours of bright sunshine	8·2

General weather conditions : The weather was generally fine and dry throughout the month. Both day and night temperatures were below normal during the first half of the month when typical winter conditions prevailed. Temperature rose to above normal during the second half during the day but continued low at night.

The weather was dominated by anticyclonic conditions to the north of the area which determined northerly winds.

P. V. R. & T. S. L.

Departmental Notifications.

I Circle. G. Sitharamasastri, A. D. Vijayanagaram, extension of l. a. p. on m. c. for 20 days from 3—2—33. A Rammohan, A. D., Rajahmundry extension of leave on m. c. for 1 month from 21—1—33. **II Circle.** M. V. N. Sastri, A. A. D., l a. p. for 8 days from 3—1—33. Y. Venkateswara Rao, A. A. D. Bapatla, l. a. p for 6 weeks from 11—1—33 on m. c. P. Gopalratnam, cotton Assistant, Guntur, extension of l. a. p. from 22—1—33 to 11—2—33. **III Circle.** K. Hanumantha Rao, A .A. D Rajampet, extension of l. a. p. for 2 days on 13th and 14th January 1933. S. Muthuswami Iyer is put in charge of the Exhibition Vans Unit 1, touring in the Bellary District for two months from 28—1—33. K. Balaji Rao, A. A. D, Tadpatri, will be in additional charge of Gooty sub-circle for two months **IV Circle.** *Transfers.* K.V. Natesa Iyer, A. D. Kallakurichi to Cuddalore sub-circle, and K. B. Vydeeswara Iyer, A. D. Cuddalore to Kallakurichi sub-circle. R. Narasimha Iyer A. A. D. in Mycology, extension of l. a. p. for one month and 9 days from 23—12—32 in continuation of l. a. p. already granted. **V Circle.** S. Mahadeva Iyer, A. D. Ariyalur, l. a. p. for one month from 18—1—33. **VII Circle.** B. Narasimha Pattathan, A. A. D. Coondapore, l. a. p. for 18 days from 14—1—33 to 31—1—33 with permission to prefix 12th and 13th January. **VIII Circle.** M. Subramania Pillai, A. D. Tiruppur, extension of l. a. p. for 14 days from 3-2-33 to 16-2-33. D. S. Subrahmania Iyer, A. D. in charge of vans, l. a. p. for 15 days from 27—1—33 **G. M's Section.** D. Marudarajan, Assistant, l. a. p. for one month from 20—1—33 **O.S. S's Section.** A. P. Balakrishna Nair, F. M. Pilicode, l. a. p. for 15 days from 25—1—33. T. Gopalan Nair, F. M. Nileshwar No. iii, extension of l. a. p. for one month in continuation of leave already granted. **P. S's Section.** S. Dharmalingam Mudaliar, Assistant l. a. p. for 21 days from 1—2—33. M. K. Padmanaban, Assistant, l. a. p. for 4 days from 3—1—33 to 6—1—33 and l. a. p. on m. c. from 7th to 11th January 33 with permission to prefix Xmas and New year holidays from 28th December 1932 to 2nd January 33 and to suffix Pongal holidays on 12th and 13th January '33. **D. A's Office Orders.** *Promotions:* U. Vittal Rao, F. M.. A. R. S. Samalkota, from II to I grade. T. R. Venkaswami Rao, A. D. Tiruvallur from iii to ii Grade. M. Sanyasi Raju, Bacteriology Assistant, Research Institute, Coimbatore, on leave out of India is permitted to return to duty cancelling the unexpired portion of his leave. T. S. Lakshmanan, now offg. as Assistant, Chemistry section Vice Sanyasi Raju on leave, will from the date of the latter's return to duty, officiate as Assistant in the Chemistry section Vice M. Suryanarayana, on other duty displacing K. Veerabhadra Rao. A. Chinnathambi Pillai, Upper subordinate Agricultural section, extension of l. a. p. for one month and 7 days from 23—12—32 to 29-1—33 and leave on half average pay for 2 months and 2 days in continuation thereof. R. Anandapadmanabha Pillai, Upper subordinate, whose officiating appointment will cease on the 2nd February, will continue to officiate till 31st March '33 Vice A. Chinnathambi Pillai. **Gazette Notifications.** Mr. S. R. Venkatakrishna Mudaliar, Asst. Mycologist, Extension of l a p. for 3 months from 4 2-33. Mr. K. M. Thomas, Upper Subordinate, Mycology section to act as Asst. Mycologist for 3 months from 4 2-33.

ADDITIONS TO THE LIBRARY DURING NOVEMBER 1932.

A. Books.

1.	Economic Ivestigations in the Hyderabad State 1929 30. Vol. II -Nanded District	*Kesava Ayyangar, S.*	1932
2.	„ III--Warangal ..	..	„
3.	„ IV—Aurangabad „	„	„
4.	„ V - Raichur „	„	„
5.	Pyrheliometers and Pyrheliometric Measurements —(U. S. A. Weather Bureau Circular)	*Kimball, H. H.*	„
6.	Some Aspects of Plant Nutrition (Society of Biological Chemists, India, Publication)	*Viswanath, B.*	„
7.	Indian Culture through the Ages—Vol. II—Public Life & Political Institutions	*Venkateswara, S.V.*	„
8	Telugu Equivalents of English Terms in Natural Science	*Madras Govt. Publication.*	„
9.	Village Officers' and Ryots' Manual	,	1931.
10.	Madras District Gazetteers—Statistical Appendix for South Arcot District—Vol. II.	„	1932.
11.	Do. for Salem District Vol. II.	„	„

B. Reports.

1. Annual Report of the National Institute for Research in Dairying for 1931. 2. Annual Report of Agri. Dept. Uganda Protectorate for 1931. 3. Do. for St.

Kitts-Nevis for 1931. 4. Do. for Agri. Exp Stn. Arkansas 1931—32. 5. Do. for Hawaii 1931—32. 6. Do. for Missouri 1929—30. 7. Do. for New York 1930—31. 8. Do. for Wisconsin „

C. Bulletins and other Publications.

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[†] SOME EXPERIMENTS ON THE CONTROL OF THE ROOT-GALL NEMATODE IN SOUTH INDIA

By P. N. KRISHNA AYYAR, B.A.,

(Madras Agricultural Department).

Introduction. The control of the Root-Gall Nematode worm *Heterodera Radicicola*, Gr.[*] has been the subject of extensive and earnest investigations for the last fifty years in many countries both in Europe and America. Since this worm has been for long recognised as the cause of one of the most serious diseases which crops are subject to, a good deal of literature has arisen and many useful facts have been accumulated on the question; consequently the problem has advanced to a great extent along many and varied paths of enquiry. One of the most interesting and fruitful lines of research among these has been the increased attention paid to the bionomics of the pest which might provide the key to the problem of its control.

[†] A paper read before the Indian Science Congress, 1932.

[*] The correct name for *H. Radicola Greeff* appears to be *Heterodera marioni*, (Cornu, 1879) Goodey, 1932 the specific name *radicicola* being preoccupied by the Genus *Anguillulina* [I. B. A. P., 5, 1932].

The Nematode is essentially (in the free-living condition) a soil inhabiting organism. The main objective of the studies, therefore, has been confined to the eradication of the pest from infested soil which has been one of the most important and perrennial sources of infection and spread of the disease. The Nematodes are microscopic and cannot, therefore, be tackled in the field. It is also impracticable to treat live plants after infestation. Hence the soil has been the main target of attack and various are the methods devised against the evil effects of the organism among which sterilisation of soil by chemical heat or cultural means has attracted the greatest attention. Numerous experiments in the treatment of the soil by the use of chemicals in solid, liquid and gaseous conditions have been in the past carried out intensively in various parts of the world but the need for further investigation is in no way diminished as no effective, cheap and practicable method of complete eradication of the pest, which can be of universal application, has been evolved yet.

In a previous paper (3) contributed to the Indian Science Congress 1925 the results of the writer's preliminary studies on the subject such as the occurrence of the disease, its nature and symptoms etc. were embodied. Since then the work has been, though intermittently, continued. It is the aim of this paper to set forth the results of the subsequent studies with regard to the range of host plants and distribution in South India, seasonal variations, some resistant varieties of plants, mode of infestation and other related aspects as also to describe briefly some experiments on soil disinfection conducted to bring it under control under South Indian conditions.

Host Plants in South India. The Nematode is abundant and wide-spread in South India and the extent of injury to economic crops is appreciable in many instances. Unfortunately however, no reliable data on these aspects are available in South India although numerous instances of its ravages on a variety of crops have been known from different parts of the province. Since the publication of a preliminary paper on the subject, the Nematode has been observed on an extended range of host plants as well as the extent of its distribution in South India. With a view to present a full account as also to note the new localities where the parasite has been found to occur, a list of plants already known to be susceptible in South India has been advisedly included with a few photographs of infested plants. The list as presented below comprises mostly those noted by the writer and a few recorded by Barber (1). Thus the host range of *Heterodera radicicola* as far as is known has been brought up to date with regard to this country.

New Host Plants Noted in South India.

Scientific name	Popular name
Pisum sativum	Peas
Antirrhinum majus	Snap dragon
Zinnia elegans	Zinnia
Phaseolus vulgaris	French bean
Tithonia diversifolia	Mexican sunflower
Impatiens balasmina	Balasam
Amarantus caudatus	Love-lies-breeding (Crimson)
Amarantus gangeticus	Thandu keerai (Tamil)
Braassica juncea	Mustard
Helianthus annuus	Sunflower
Lactuca sativa	Lettuce
Abutilon indicum	
Cucurbita maxima	
Chrozophora Rottleri	(A common weed)
Musa paradisica	Plantain
Vigna catjang	Cow pea
Cucumis sp.	Cucumber
Dioscorea alata	(Mal. Kachalkilangu)
Cyamopsis tetragonoloba	Cluster bean
Canavalia ensiformis	Sword bean

Host Plants Previously Noted from S. India.

Scientific Name	Popular or Common Name
Capsicum annuum	Chillies
Nicotina tabacum	Tobacco
Canna indica	Indian shot
Curcuma longa	Tumeric
Brassica oleracea (var)	Cauliflower
Brassica oleracea	Cabbage
Apium graveolenes	Celery
Brassica caulorapa	Knol-khol
Daucus carota	Carrot

Host Plants Previously Noted (*contd.*)

Scientific name	Popular name
Beta vulgaris	Beet
Piper betle	Betel
Piper nigrum	Pepper
Sesbania aegyptiaca	Daincha
Hibiscus esculentus	Bhendai
Hibiscus cannabinus	Gogu
Coleus parviflorus	Koorkai (*Mal.*)
Dioscorea	,,
Cucumis sativus	Cucumber
Camellia thea	Tea

Cinchona sp.	Cinchona
Impaticus kleinii	„
Sida rhombifolia	„
Triumfetta rhomboidea	„
Centratherum reticulatum	„
Emilia zeylanica	„
Oldenlandia sp	„
Desmodium sp.	„
Ageratum conyzoides	Goat weed
Mullungo pentaphylla	
M. stricta	

Extent of The Disease and Personal Activity. The disease, as may be apparent from its occurrence in very widely different localities, is common throughout South India and it sometime develops into a serious malady causing severe losses. During certain seasons of the year the Nematodes appear to be less numerous and active. As a result of observation for many years it may be noted that in South India these multiply and thrive well in the period extending approximately between the months of August and February although isolated cases of their occurrence may be seen all the year round.

Some Nematode Resistant Plants. In nature among cultiveted crops certain varieties of plants are seen to be comparitively resistant to *Heterodera* as may be evident from the absence of any trace of root-galls in certain plants growing in infested soil. By the cultivation of such plants in infested localities for a few years it has been found that the nematode population in a given plot may be considerably reduced and possibly completely starved out in the course of time. When susceptible crops are scrupulously eschewed and such resistant varieties are persistently grown in the soil, the activity of the worm may continue for some time with the available food in the soil, but sooner or later the store of food reserves will be depleted with the result that worms are slowly killed by starvation. Such beneficial results have been noted by the writer in the course of his limited observations though no systematic efforts in this direction have been carried out. In a plot which was observed to be badly infested, cholam (*Andropogon sorghum*), ragi (*Elusine corocana*), red gram (*Cajanus indicus*) and maize (*Zea mays*) were grown though not by design and these were repeatedly examined to see if they are subject to the attentions of the pest. These have always been found to be free and therefore the writer has concluded that these may be included among the disease resistant crops in South India. In such a plot the most susceptible crops such as knol-khol, tomatoes and other crops have been grown later. On examination of these plants the writer noted that the attack has been generally less severe indicating thereby that the Nematode population of the area has been greatly reduced. It is clear therefore that a systematic and judicious rotation

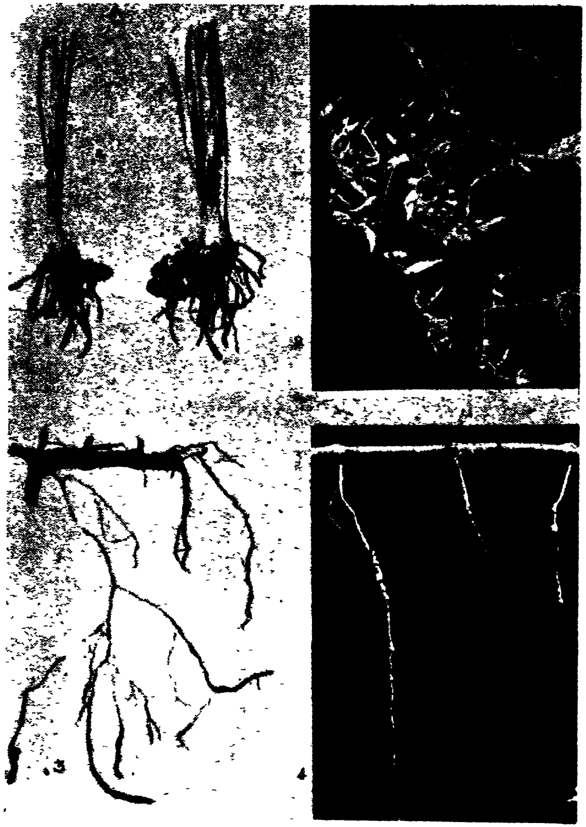

Plate B.

Plate A.

Plate A.

Development and life-cycle of H. radicicola (Greef) Muller. original (all drawn from author's own slides).

1 to 7.	Eggs in various stages of segmentation (greatly enlarged).
8 to 9.	Young worm coiled inside egg membrane in different stages of growth. (enlarged).
10(a, b, c, d).	Various forms of immature larvae.
11 to 14.	Various stages in the distension of the larvae.
15 to 16.	Young female cyst in different stages.
17 to 18.	Female showing genital tubes and ovaries small and large ova.
19 to 20.	Male undergoing transformation. (metamorphosis).
21 to 22.	Fully formed mature male. (enlarged).

Plate B.

1. Roots of Turmeric (Curcuma longa) infested with *Heterodera radicicola* showing enlargements (original).
2 Tomato plants (Lycopersicum esculentum) showing nature and symptoms of attack by H. radicicola.
    Left—Moderately attacked.
    Middle—Unaffected.
    Right—Thoroughly infested. (original).
3. Betel vine roots (Piper betel) showing enlargements caused by H. radicicola. (original).
4. Adventitious roots of cucurbita maxima (sweet gourd) heavily attacked by H. radicicola. (original).

of such immune varieties like cholam, red-gram, ragi, and maize for a few years may prove an easy and effective method for a gradual elimination of the pest from the soil. But it is doubtful whether such plants will ever remain immune to the attack of worms, especially in the light of reports that some plants considered to be resistant proved to be susceptible later on.

Some Control Experiments. *The Experimental Plot and Host History*: Various measures of control against these plant-parasites have been recommended, but the efficacy of none has been proved under South Indian conditions. Hence some experiments including a few chemical treatments of soil were planned to be carried out in the Botanical gardens attached to the Agricultural College, Coimbatore. Before embarking on a description of the experiments it may be of interest to record the spread of this disease in this garden in view of the emphasis laid on a knowledge of the host history of the particular strain or population of Heterodera experimented with. Although the presence of this pest was known by isolated cases of occurrence the writer ventures to suggest that this pest was first discovered by him in the garden about ten years back in cauliflower roots. How long prior to this period the parasite has been in the garden soil or how it has gained entrance are only matters of conjecture as the organism is a stealthy foe. The spread of the disease in the garden and the variety of plants attacked later on may have a bearing on the history of host selection and specialisation, a study whose significance has been markedly brought out by Steiner (4). It is noted that it spreads rapidly and its progress cannot be easily arrested. From a knowledge of its life history (*Vide* life history plate) the pest is noted to be prolific, each female being capable of producing about 500 eggs and of undergoing nearly ten generations a year. It may be noted here that the mechanical injury caused to the plant tissue by "mouth spear" is probably insignificant compared to the toxic effect produced by their salivary secretions. The reaction set up by the latter coupled with that of their excreta may be the real cause of the development of the galls so characteristic of the affection. To follow the course of its progress provides interesting reading. From cauliflower the parasite soon extended its range to its near allies such as cabbage, knol-khol, carrot, radish etc. in a few months. A little later it began to show its preference to tomatoes grown in the neighbourhood as was evident from the numerous large galls on their roots. After a season brinjals suffered badly by their attentions. These plants grown in a fairly large plot were heavily attacked without any exception. The ravages of the pest on these plants accentuated the need for control measures. Subsequently crops like peas, amaranthus and various ornamental and flower plants like balsam, sunflower etc. suffered in quick succession in varying degrees.

Favourable Conditions and Means of Dissemination: The raid increase of the pest and the widening of the range of host plants naturally led the writer to investigate the conditions favourable to its multiplication and dissemination. The soil in the garden is most conducive to its prolonged life and activity being a sandy and porous loam of loose texture with sufficient moisture. In contrast to this they are not so abundant in other portions of garden as has been gathered from the degree of infestations in plants in portions of garden having heavy clayey soil or in spots which are sometimes either waterlogged or completely dry. Coupled with these conditions there is a constant and uninterrupted supply of food in the gardens. In short, all conditions and practices conducive to better and intensive farming such as irrigation, good drainage, etc., all appeared favourable to the growth and multiplication of the organism.

As to the means of the transmission of the nematode to fresh localities, observations indicate that the main cause is to be traced in this country to heavy rains and consequent flow of water from place to place. Irrigation, of course, forms an important means of infestation. To a certain extent the transportation of movables—such as agricultural implements, manure heaps from infested soil, affected roots of live and dead plants, are also potent causes of its spread to different localities. Animals and man treading infested and free soils also help the transference of the pest through the moist soil clinging to the limbs. Fortunately, by its efforts the parasite is known to move for only short distances within a few feet, which adds additional proof to show that the main causes of dissemination are those detailed above.

Treatments. This heavily infested garden soil afforded an ideal ground for the conduct of these experiments. Beyond doubt the soil was literally alive with Heterodera. The experiments were actually commenced by the end of the year 1921 and continued up to the beginning of 1926. A strip of ground sufficiently large in extent was divided into rectangular areas of 5 x 4 feet and each plot was isolated from the rest by means of four broad wooden plants sunk to a depth of a foot and a half into the soil along the sides of the plot. This resulted in a box-like arrangement for each of the fifteen plots. Five of these plots were reserved as controls. Two were kept for partial sterilisation and trap-crop. Each one of the eight remaining plots was treated with one of the following substances, the rate, the number of treatments and the intervals between treatments being as indicated below. The soil in each plot was saturated with the required quantity of solution after ascertaining the same by actual trial with small samples of soil.

Substance	*Proportion*	*No. of treatments and intervals*
Carbolic acid	1 in 15 parts of water	three times with an interval of 9 days between treatments
Kerosine	2 gals. for the whole area	once
Formalin	1 in 25 parts of water	do
Potassium cyanide	200 lbs. per acre	Two treatments with an interval of 8 days
Carbon bisulphide	4 oz. per sq. yard	once
Lime	27 lbs. for whole area	do
Sulphuric acid	1 in 80 parts of water	do
Ranicide	½ oz. per sq. feet	do

Partial Sterilisation : The soil in one plot was sterilised by burning cholam stalks and other materials ; then it was loosened and spaded at intervals. The process was repeated thrice with an interval of two days between treatments.

Trap Crop. As suggested by Kuhn the method of trapping the worms by growing a very susceptible crop along with the valuable crop and uprooting and destroying the "catch" or "lure" plants in time before the worms have begun to emerge from the roots and reinfest the soil, was given a trial in one of the plots. Hence one of the cruciferae namely *knol-khol* was grown along with the test crop.

Sowing and subsequent observations Various lengths of time had to be allowed to elapse after each treatment before the planting of the test crop, and the treatments themselves were so timed as to allow planting of all plots simultaneously. Accordingly all the plots were sown with peas on 10—2—25 but as peas failed to grow well brinjal plants grown in free and uninfested soil elsewhere and found to be free from elworms after examination were planted. These plants were found to grow well though not very vigorously. After the lapse of about one month, one plant from each plot was dug up with roots intact and examined. Thereafter periodical examinations of the plants from the several plots was continued for several months. The results of the examination can be roughly expressed as follows:— The plants from the control plots invariably showed a heavy infestation compared with those in the experimental plots. Those in the experimental plots exhibited different degrees of attack which is very difficult of interpretation. The plants from carbon bisulphide plots showed a doubtful infection and plants from kerosene plot showed infestations more or less similar to the controls indicating thus the other extreme and the utmost that could be done by a very wide stretch of the results is to group the other treatments into three or four categories between these extremes. Those that are grouped together showed no marked differences in the degree of infestation as noted from the galls produced. But yet the writer feels that the effects of the different treatments may approximately be expressed in the following manner arranged in the descending order of severity of attack:—

Kerosene—More or less severe attack having many galls.

Sulphuric acid Ranicide Carbolic acid Pottassium cyanide	Not so severe—fewer galls.
Partial sterilisation Trap crop.	Mild—a few galls.
Formalin Lime	Slight—(There were galls).

Carbon bisulphide—Doubtful attack.

Although these observations were continued for a long time no further comparisons could be made as all plants in some plots died. In November 1925, the plants in carbon bisulphide plot were seen to have clearer infestation showing that this plot also has not escaped the attentions of the Nematode.

Interpretation of Results. The microscopic and other examinations of the plants in the different treated and control plots from time to time and a comparison of the same as far as possible did not lead to any definite conclusions as was anticipated but it must be admitted that these served to throw light on the intricacy of the problem in question. It was not possible under the conditions of the experiment and the unexpected difficulties and complications that cropped up in its course to calculate the percentage of attack or accurately demonstrate the relative values of the chemical heat and trapping treatment by reliable data or concrete figures. The best method of expressing results would be a comparison of respective yields but under the circumstances that was obviously out of the question. It was only possible in an approximate and empirical manner to estimate the extent of infection and express the effects of treatments in terms of degrees as severe, medium, and mild or slight. It was even difficult in some cases to differentiate the degrees of infestation in certain treatments and hence these have been grouped together as having more or less similar infestation. Certain facts have however been brought to light as for instance that *all treated plots with the exception of kerosine were generally better than the controls* as seen not merely from the less severe attack but also from the time taken to develop the galls in a few cases. It can also be seen that the effect of the various treatments continued to last though in diminished extent for varying periods ranging from two months to six months.

To be more precise, as infestation occurred both in control and treated plots though in the latter in varying degrees of severity it may be safely concluded that none of the treatments have been effective in the complete eradication of *Heterodera.* The treatments, at least some of them, certainly caused a reduction in the population of the worms in the treated soil for the time being as shown by the diverse degree of infection and varying lengths of time taken to produce the characteristic galls. It is also evident that within a short time i. e., a few months, the Nematode is able to restock the treated plots with the normal population. Evidence then indicates that such sterilisations of soil by treatments can only be of temporary benefit and the relief obtained lasts only for a few months, the period of duration of such a beneficial condition, varying with different treatments and probably also with different concentrations of the same substances. Hence such treatments can be utilised to minimise damage to valuable crops which under the circumstances, is *not a mean* achievement.

The other causes of a partial failure of the experiments were inherent in the methods of control themselves. The first and foremost cause under this category that suggests itself more prominently than others is that, since the several plots were more or less well isolated, the worms or eggs were not completely killed by the treatments either because they were hardly enough to withstand the effects of chemicals etc., or they were at depths beyond the reach of the application. Another probable reason for their presence may be that certain stages in their life are such as to have some means of protection against adverse effects.

The investigations by Godfrey (2) in regard to the depth distribution of *Heterodera radicicola* clearly show that these are distributed in the soil in varying depths according to the conditions of soil, season and availability of moisture, etc., and the efficacy of any treatment is to be judged by the depths to which the treatments can extend their influence. Hence to determine the depth to which the treatment has to be extended, it is necessary to make a study of each locality in regard to the Nematode content of soil at varying depths in different seasons. This is one line of investigation which requires urgent attention if any success is to be had in the control of these worms.

In order to see whether the eggs or larvae of these worms in the soil develop any protective structure while in the soil, so as to withstand any adverse effect of heat or chemical, it is necessary to know more about the life history of the worm in the soil. All that is known is that larva is unable to develop beyond the larval stage until it gains access into the root of a host plant, and then passes through several stages in the root and ultimately develops into a male or female as the case may be. But so far as the writer has been able to gather from literature on the subject none of the previous workers have directed their attention to the possibility of the young worm remaining in the soil for long periods in a slightly different condition from the one supposed to exist.

Other Methods of Control. Various other methods of control are being tried in other countries among which the breeding of Nematode resistant varieties of plants is a very promising field of investigation. Another method which has been suggested but not demonstrated to be effective, is that known as biological control whereby a voracious species of Nematode *Monnonchus papillatus* is sought to be utilised, for exterminating Heterodera on account of its predaceous instinct. Flooding the infected portions of fields with water for a week or two, and drowning the worms has been recommended but it is not always practicable. Hot water treatment and steam sterilisation of soil have been reported to be effective in the case of limited areas of infested land.

Conclusion. The experiments described in the paper although unfortunately few in number and inconclusive in results, may, it is hoped, serve at least the purpose of bringing into prominence the serious nature of the problem in South India as also the various factors which have to be taken into account in devising control measures and the unexpeted developments that have to be guarded against in the course of trials. The foregoing paragraphs may also serve to show how little is known of this serious pest in India and that the problem, though not easy of solution, affords a highly promising field for exploration. Sufficient, it is believed, has been said to induce interest in the subject and to indicate the lines along which further investigations may profitably be accomplished and the writer will feel more than satisfied, if by these attempts, the problem has been brought any the nearer of solution. Opportunity is taken here of expressing the writer's deep indebtedness to the Govt. Entomologist, M. R. Ry., Rao Sahib Y. Ramachandra Rao Garu, and to the Principal, M. R. Ry., C. Tadulinga Mudaliar Avl., for affording facilities for the investigation and to all those whose writings have been drawn upon in preparing this paper. The writer's most sincere thanks are tendered to Dr. T. V. Ramakrishna Iyer for his unfailing kindness and encouragement in this as well as similar studies.

Note:—Since presenting this paper for the Indian Science Congress the writer had an opportunity of seeing (by the kind courtesy of Col. A. Olver, C. B., O. B. E., etc., of the Imperial Council of Agricultural Research in response to writer's request) a monograph on " the Root-infesting Eelworms of the genus Heterodera " published by the Imperial Bureau of Agricultural Parasitology, London (1931) which gives an up-to date and exhaustive list of host plants so far noted all over the world together with a complete list of Bibliography the value and usefulness of which can never be over estimated for workers in this field. It is obvious that the writer could have saved much time and labour had he come across this important publication before the preparation of this paper especially in the matter of hunting up the scattered literature on the subject.

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† NATIONAL WELL-BEING & AGRICULTURAL IMPROVEMENTS

By M. ANANDAN, L. Ag.

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We have, in common, with the rest of the world, been passing through an unprecedented economic depression for the past two years. Following, as it did, on the heels of post-war years of high prices and apparent prosperity, the effect of the depression seems to have been magnified more than it would have appeared under normal pre-war conditions. No two economists are agreed either as to the real causes for the depression or with regard to its remedy. Some say that it is due to over-production of commodities more than is justified by world demand, some say that its cause is to be traced to reparations and war debts, while others say that it is due to the combined effect of world-wide over-mechanisation of the means of production resulting in unemployment of man and animal labour and the natural increase of world's population. It seems to me that all the above factors either singly or in combination have contributed in varying degrees to the present depression. It is reported that the International Statistical Institute estimates that between the years 1920 and 1928, 125,550,000 had been added to the world's population The Indian contribution to this increase has been in the neighbourhood of 25,000,000. The remedies suggested for getting over the economic ills of the world are also of various kinds, removal of tariff walls, organisation of exchanges on a new basis like the bartex sponsored b the London Chamber of Commerce, 'Erne' proposed by Dr. Fowler in India, actual barter of commodities between nations as the exchange of American wheat and cotton for Brazilian coffee, and Russian petrol for Egyptian cotton and international agreements imposing restrictions on the production of commodities like sugar in Java, Cuba and Europe, rubber in Dutch East Indies, Malaya and other rubber producing countries.

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† Paper read at the Agricultural Conference held under the auspices of the Trichinopoly District Agricultural Association at Srirangam on 4th January 1933.

While over-production and over-mechanisation may be the causes for the unemployment and economic depression in other countries of the world, India's ills, on the other hand, have been, in normal times, and are to a great extent, even in this period of depression, due to under-production and non-mechanisation, particularly of its basic industry of agriculture. Under-production and over-population, I believe, have combined more than anything else to keep down the standard of life of the average Indian. In other words, the cost of production per acre of any staple crop in terms of its yield is so high in India, that countries not so well placed as India as regards climate and soil for crop production have been able to dump their produce on the Indian market and even to threaten to oust the indigenous produce in this competition. Australian wheat and Java sugar are examples. These countries have been able to do so by the application of scientific knowledge and methods for higher crop production and cutting down cost all along the line by efficiency in operations. To make the point clear, I may tell you that Java produces on an average, 65 tons of cane from an acre while India's average is about 35 tons from the same acre. We, at the same time claim, that India has the largest area under sugarcane and suitable for its cultivation. What lee-way we have yet to make, to come on a par with Java in this respect, needs no stressing from me. The same case holds good more or less, in respect of all other crops that enter into competition with other countries in the world's market.

Coming nearer home, we have the case of Tanjore rice unable to compete with that of Burma or Indo-China in the Ceylon market for the same reasons, as amply proved by Mr. N. S Kulandaiswami Pillai, the Deputy Director of Agriculture of this Circle, in his recent report on his enquiry into the prospect of Tanjore rice in that island. A reduction of a rupee in the cost of production, or an extra yield of a rupee from every acre of paddy in the Tanjore Delta, would mean a saving of a million rupees every year. If the mirasdars of Tanjore owning this million acres of rice fields save this amount in a year, they may charter a steamer of their own and transport their rice more cheaply to Ceylon and the West Coast.

So anything made to raise the standard of production of Indian agriculture means simply the raising the standard of life of 75 % of the people of India, and indirectly that of the remaining 25 % of the population also, as almost all the other industries in the country derive their strength from this basic industry. India is forging ahead with other industries in a remarkable way now, and as more and more industries get established, to that extent, we may foresee that many millions now engaged in agriculture would be diverted to such industries. This diversion should be welcomed as it would, in addition to relieving the undue pressure of population on land surely stimulate and strengthen the industrial outlook of the people and make them more industrially-minded than they have been in the past. But this diversion of agricultural labour to industries will have consequences of far-reaching effect on the traditional methods of production employed in agriculture. One sure result would be the use of more and more labour-saving and efficient implements in crop production, in other words, mechanisation of production to an appreciable extent, though not to the extent of managing a 1000-acre farm by a couple of men with the help of machinery. Such drastic mechanisation is not generally adaptable to Indian conditions and even if possible, does not seem to be desirable. This partial mechanisation would be enough to create a huge industry of agricultural implement manufacture. There should be many more Kirloskar Brothers to cope with the demand. This solitary example is enough to show what healthy reaction, agricultural development on improved lines will have on the industries of the country.

The first concern of agriculture should, of course be, to produce a sufficiency of food crops to support the huge population of men and domestic animals in the country. This itself would task the resources of the agricultural industry to a great extent and more than this, the demand of industry for raw materials in sufficient quantity, and of high grade in quality, would be certain to increase as years go on. This means, again, adoption of all possible methods of production, and production of commodities of the highest grade in quality. Let me now briefly touch upon the various methods that we can adopt for improving the productive capacity of our soils and crops.

Soil management itself is a problem of such vast magnitude and importance that no *mirasdar* can ignore it if he is desirous of getting profitable returns out of his land. The land should be laid out in proper way for facilitating irrigation, and still more, its drainage. Neglect of draining fields at the proper time has caused, in many a case, utter failure of the crops grown on them. Most destructive diseases of crops also appear when this operation is neglected. Red-rot of sugarcane is a typical instance.

Cultivation of soil at the proper time and with the suitable implement, is of such vital importance to the growth of crops that the fact cannot be over-emphasised. This fact, though known to many, is not generally adopted. It is easy to imagine that, as the roots of plants are the real organs concerned in gathering nutritive materials for building up a plant from the soil, all facilities afforded for their easy spread in the soil in all directions will be reflected in the final produce from a crop. That this is the result has been amply proved by the increased yield of paddy, cholam, cotton and other crops obtained by deep ploughing with improved iron ploughs. An increase of two *kalams* of paddy per acre is a certainty by the adoption of this improvement suggested by the agricultural department.

Seed rate. The adoption of a higher or lower seed rate than is normal for a crop will pull down its final yield. It has been amply demonstrated that, in the case of paddy, *mirasdars* are using at least double the seed rate that is required for raising a normal crop. Ryots generally use 36 madras measures per acre in the case of *kuruvai* and 24 madras measures in the case of *samba*, while the department advocates only half of this as more than sufficient for planting an acre. There are 11 million acres of paddy land in this Presidency and a universal adoption of this seed rate for paddy would result in a saving of at least 5½ million rupees even in these days of low prices for paddy. It is really a criminal waste if we realise the fact that more than 150 million madras measures of paddy are thrown away in the fields when it would have fed a million people for more than 6 months.

Manuring: When we harvest and sell a crop off a field, it means that we have impoverished the soil to that extent. So, if we are to maintain and increase the crop producing capacity of a soil, we must put back the plant food removed in the shape of crops, through suitable manures. Different crops require different combinations and quantities of manures. So great care will have to be exercised in the choice and dose of manures given to a crop. It has been proved by actual experiments that crops respond, under South Indian conditions, to the application of phosphatic and nitrogenous manures when given in combination with organic matter. A net increase of at least 2 *kalams* of paddy is quite possible by the adoption of the manurial combinations and doses advocated by the department.

Use of improved strains of seed: Anything from 10 to 25 % increase in crop yield is possible by the use of improved strains of seeds of various crops evolved at the Agricultural Research stations in the Presidency. The paddy strains evolved at the Agricultural Research station at Aduturai, have replaced the ordinary varieties in more than 2 lakhs of acres in Tanjore and Trichinopoly districts. And it is only a question of a few years more, before the whole area under paddy would be planted with improved strains in these two districts.

Rotation of crops: Wise rotation of crops is a great necessity both for the maintenance of soil fertility, as well as for avoiding the risks resulting from relying on a single crop, in times of depressed prices. It is always a sound plan " not to put all your eggs in one basket ". The lesson that the Malaya rubber planter and Tanjore rice grower have learned in this regard is a sufficient warning for all.

Side lines of agriculture like dairying, poultry-farming, bee-keeping, and fish breeding should as far as possible be combined with agriculture for greater profits.

Reducing cost of production is another method that can be adopted for successful farming. This may be achieved in various directions. It is, indeed a question of farm economics. Practical methods for adoption are (1) the better preservation of cattle manure, (2) conversion of all waste products into composts for use as manure, (3) use of efficient implements, (4) cutting down maintenance and feeding charges by using fewer and better type of animals for agricultural purposes.

Preparation of produce for the market and its transport are other directions in which enormous improvement is possible in Indian agriculture. Take for instance the case of plantain grown extensively in your district. As it is an extremely perishable product and as the crop comes on the market all at a time, the price of fruit falls to an alarming extent, to make the cultivation of this crop almost an unprofitable business. There are two ways of getting over the difficulty. One is speedier transport of the fruit to North Indian markets, perhaps, under cold storage. In this direction, the Director of Agriculture is personally interesting himself and I understand, has an idea of taking a representative of the Trichinopoly Plantain Growers' Association to North India with him for studying the market facilities there in co-operation with the Agricultural departments of the various North Indian Provinces.

Another direction in which I am trying to solve in a small way this problem of slump in plaintain trade is by trying to convert plantain fruits into ' figs ' by sun-drying the fruits under proper sanitary conditions. Plantain figs of excellent quality and flavour are now being made on the Agricultural Research Station at Aduturai. The dietetic value including the vitamin content of these figs, will be tested shortly. From the figures so far gathered, I find that a 100 lb. bunch of plantain when dried gives 15 lbs. of fig and that well prepared figs keep well for more than a year From the above it is clear that we can reduce considerably the freight on fruits by marketing them as figs and also regulate the supply throughout the year. It would also enable us to send the product to foreign markets. Plantain fig making can be easily introduced as a cottage industry. The precautions to be taken are that the fruits will have to be dried under fly-proof conditions and that no attempts should be made to make figs during damp and cloudy weather, as they easily get mouldy under such conditions.

In conclusion, I assure the mirasdars of Tanjore and Trichinopoly that no improvement is advocated by the department for adoption that has not been put to rigorous tests on the Research stations and request them to make use of those improvements for raising the level of crop production in this country.

TOMATO OR LOVE APPLE

BY K. K. RAGHAVAN, L. Ag. (Hons).

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Introduction. Of all vegetables that have recently come to the forefront, Tomato (*Lycopersicum esculentum*) must be given a very prominent place. It is the cheapest and most easily grown vegetable and a very valuable fruit from a nutritional view point. It contains vitamins A, B and C in plenty and is one of the richest sources, of these. This paper is only an attempt to record in brief outline, some of the observations made and experience gained during the last two years, when the writer was privileged to be in charge of the orchard and vegetable garden in the Central Farm. As the value of vitamins in human and animal nutrition becomes increasingly known this fruit is bound to come to greater prominence. It is both a fruit and a vegetable and since it can be eaten raw, the vitamins contained in it are not lost. The analysis of the fruit as determined by the Government Agricultural Chemist is interesting.

Results of analysis of Tomato for its food value.

Heads of analysis	Tomato (raw)		Tomato (ripe)	
	% on dry weight.	% on green weight.	% on dry weight.	% on green weight.
Moisture	...	95 48	...	93 61
Ash.	14 07	0·64	16·92	1·08
Proteids	21 20	0·96	24·35	1·56
Ether extractives	6·40	0·29	6·40	0·41
Fibre	12·68	0·57	14 79	0·95
Carbohydrates	45·65	2·06	37·54	2·39
	100·00	100·00	100 00	100·00
Insoluble mineral matter.	0·15	0·01	0·17	0·01
Albuminoids	15·77	0·71	18·44	1·18
Phosphoric acid	1·22	0·06	1·38	0·09
Potash	6·54	0·30	7·44	0 48
Lime	0 31	0·01	0·33	0·02

From the above table it is apparent that the tomato contains a high percentage of moisture at all stages. It is high in protein and hence of great value as a food. It is also low in fibre and hence easily digestible. It is high in ashes and contains a large percentage of phosphoric acid and potash. It is deficient in lime. The food value also increases as the fruit ripens.

The cultivated tomato of to-day is a native of Tropical America. It has undergone a series of changes before it attained the present level of perfection.

Soils. It can be easily grown on all types of soils. But on a rich sandy loam with good facilities for drainage it yields best. Under conditions obtaining in Coimbatore there is no particular season during which alone it can be grown. Irrigation is the chief limiting factor. During the hotter months of the year, however, it may be somewhat difficult to get the plants established but when once they get established, they yield profusely. With judicious sowing and planting a decent crop can be raised throughout the year. For the proper discharge of pollen and the setting of the maximum number of fruits, a dry atmosphere is most favourable. Bees have not at any time been found to visit the flowers and do not appear to help their pollination.

The preparation of the soil and the general principles of cultivation are almost the same as for any other garden crop. In places like Coimbatore and adjoining districts, where the temperature is high it is advisable to give the land a deep ploughing. If the roots of the plants come in contact with the hot soil on the surface the plants die quickly. The soil should be stirred and pulverised well before planting and a perfect tilth obtained.

Manuring. An initial dose of 10 to 15 tons of good well-rotten farm-yard manure ploughed in sufficiently early (at least a month) before the crop comes in, has been found to be quite beneficial. Artificials can be used whenever found necessary. Potash may be applied at the start and nitrogenous manures in smaller doses later on during the early growing stages. The application of too much nitrogen may induce a leafy growth which is detrimental to the yield. About 2 to 3 cwts. of potash and 1 cwt. of nitrogenous fertiliser can be applied with great advantage. The application of fresh manure seems to delay the ripening of fruits whereas the artificials hasten it.

Planting. Line planting is advantageous and in irrigated soils the field should be divided into ridges and furrows. Each furrow may be formed 3 to 4 feet apart. The seed may either be sown along one side of the ridge and water let in, or a nursery may be raised and the seedlings transplanted when they are 25 to 30 days old. The latter method is however more satisfactory as there is a considerable reduction in seed rate. The seedlings can be planted 1½ to 2 feet apart in the row. Three to four ounces of seed are quite ample to raise a nursery to plant an acre. Tomato can also be propagated by cuttings. There is no advantage, however, in so doing as the plants raised from seed are more prolific than those raised from cuttings.

Propping. The plants as they grow have a tendency to spread on the ground and require artificial support to make them grow erect. This can be done by driving in stakes 5 to 6 feet long, vertically into the ground and tying the plants on to them. Stakes can also be planted 6 feet apart in rows and horizontal scantlings tied on to these. The plants can then be easily trained on to them. It no doubt is costly. If the plants are allowed to grow on the ground without support they will grow well but intercultivation will not be possible and harvest will be difficult. The fruits that come in contact with the soil and moisture are liable to be spoilt. Propping however, does away with these drawbacks and permits of an easy access of air and sun to the fruits and controls diseases. The plants if allowed to spread on the ground strike root at every node and grow vigorously. In consequence, more fruits are produced sometimes thus more than recompensing for the damage due to rotting.

Pruning. Pruning is another operation which is greatly in vogue, The advantages of pruning under Coimbatore conditions, are, however. doubtful and it has to be done with caution if done at all. Pruning consists in pinching off the lateral shoots at an early stage so that they may not interfere with the development of the racemes produced at the leaf axils. The advantages of pruning are early ripening, reduction of disease and production of bigger fruits.

Interculture. Hoeing and weeding should be done as often as required and the area kept neat and clean Watering is also quite necessary except during the rains and the leaves should not be allowed to fade. Drainage on the other hand is equally important.

Pests and diseases. The plants are subject to various insect and fungus attacks. These have to be dealt with promptly. Spraying with Bordeaux mixture when the plants are about a fortnight old and repeated 2 or 3 times at intervals of about 2 to 3 weeks, has been found beneficial in checking leaf diseases. Besides being a fungicide, Bordeaux mixture serves as a repellant for several insects.

Varieties. There are many varieties of tomatoes in the market, showing great variation in the size, shape and colour of the fruits. There is also great variation in the thickness of the skin, in the flavour and the juiciness of the pulp. The following are some of the varieties that have been successfully grown in the Central Farm :

Golden queen, Crimson cushion, Perfection,
King Humbert, Erliana, Globe, and Large red,
Peach Ponderosa and Stone.

Notes on the varieties :—

Large Red :— Fruits in bunches of 2 to 3, large, and ribbed, of deep scarlet colour.

Perfection **is a fine early variety of a fairly good size, quite smooth and thick and of a scarlet colour.**

Golden queen is a smooth bright yellow variety of a high yielding capacity.

Stone is again a scarlet variety of a medium size, smooth and meaty with very fine keeping qualities.

Globe is a pink coloured, globe shaped, medium tomato of a good quality.

Ponderosa has a very good flavour, it is meaty, has a tender skin and fewer seeds, large sized fruit weighing up to a pound each.

Crimson cushion—fruits of a big size and akin to Ponderosa. Erliana—medium sized fruits, very smooth and solid. It is an early variety bearing in clusters.

King Humbert with shape of a large plum, produced in clusters of 6 to 8, scarlet colour, of a vigorous growth and tough-skinned. It keeps well.

Peach—a small yellow fruited variety, very attractive having a peach like appearance, fruits formed in clusters, less of acidity.

Duration. The crop remains in the field for about five months and yields fruits for about two months. If desired, the crop can be kept longer in the field but experience shows that it is not advantageous to do so. It is better to allow the fruits to ripen on the plant in which case the fruit contains a higher percentage of sugar and less of starch. A ripe fruit also contains a higher percentage of vitamins A and C. For marketing, however, it is advantageous to harvest the fruits when they are just ripening as they keep longer if done so.

Yield. The yield of ripe fruits varies from 15 to 40 thousand pounds per acre depending upon the nature of the soil, the variety, and the season at which it is grown. A mixed crop of tomato varieties planted in an area of about 2 cents during the first week of April 1932 gave a calculated yield of 28,800 lbs. per acre by about the 19th of September 1932. Another crop planted a month later gave an average of 36,000 lbs. of ripe fruits in about the same period. Among this the variety Golden queen gave 43,000 lbs. per acre. The same variety planted on 2-7—1932 gave 43,100 lbs. per acre, even though the average of all the varieties sown at that time was 24,100 lbs. The highest yield so far recorded on the Central Farm was from a 2·6 cent plot which was planted on 8—12—1931, and which yielded fruits from 25—2—1932 to 19—4—'32 It gave 48,000 lbs. per acre. The lowest yield recorded was 10,937 lbs. per acre from a crop sown in July 1931.

Economics. Assuming that the fruit is sold at 6 pies per pound, as it is done on the Central Farm, it is possible to get a gross return from Rs. 400 to Rs. 1250 per acre. The cost of cultivation including the cost of artificials may not exceed Rs. 160 per acre which means that tomato cultivation is a profitable concern. The following details of cost of cultivation will be interesting:

Details of Cost of Cultivation.

	Rs.	as.	ps.
Preparatory Cultivation ;—			
Ploughing once with deep plough and thrice with ordinary plough	7	8	0
Manure and Manuring:—			
15 tons of farm-yard manure at Rs. 4 per ton (Half of which alone is charged for tomato)	30	0	0
Cost of 4 cwts. of artificials	30	0	0
Seed and Sowing :—			
Cost of seed, raising nursery and transplanting	6	8	0
After-Cultivation :			
Interculturing and propping with bamboo stakes (these being used for more than one crop)	20	0	0
Irrigation:—			
Once in 10 to 15 days (In rainy weather only when necessary)	54	0	0
Harvesting :—			
Collecting fruits etc.	12	0	0
Total	160	0	0

Uses. The tomato is used for a variety of culinary purposes. It forms a valuable vegetable adjunct with meat and fish preparations. It finds a place in preserves, sauces and jams. The juice is valued as an invalid food because of its high vitamin contents. In the Indian household it is gaining popularity in various vegetable dishes both cooked and raw.

Conclusion. The demand for tomato in Indian towns and villages has not, however, increased so much as to warrant its production to a large extent. At the rate at which the taste for the fruit is now cultivated, there is certainly a bright future for the crop and it is hoped that a time will come when the crying need will be for more tomatoes. If the cry for eating more fruit and the demand for a cheap yet nutritious fruit, induces the average consumer to grow a few plants in his backyard to supply his own needs, the object of this short note will be more than achieved and it is hoped that the "Love Apple" will then be more endeared in the hearts of one and all.

Acknowledgements. To M. R. Ry. Rao Bahadur C. Tadulinga Mudaliar Avl., Principal, Agricultural College, and M. R. Ry., Rao Sahib T. V. Rajagopalacharyar Avl., retired Vice-Principal, Agricultural College, I am greatly indebted for facilities afforded to start the study of the crop and for valuable suggestions. I am also equally indebted to the present Superintendent, Central Farm, M. R. Ry., R. Swami Rao Avl. Some facts particularly those regarding the vitamins in the fruit were borrowed from Hunter's Encyclopaedia of Scientific Agriculture.

TROPICAL PLANT DISEASES: THEIR IMPORTANCE AND CONTROL.

By Dr. E. J. BUTLER, C. M. G., C. I. E., F. R. S.

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In the great tropical and subtropical plantation industries, such as tea, rubber, coffee, cocoa, citrus fruits, etc., large areas of permanent crops are cultivated on capitalistic lines with uniform and usually white control. On an estate of hundreds or even thousands of acres, often under highly intelligent supervision and where the produce may be worth a great deal of money, it is comparatively easy to get adopted improvements which are the results of scientific research, whether in the control of disease or in any other direction. It is quite a different matter, however, when one comes to deal with the crops grown by the indigenous people of the tropics for their own use. Their agricultural practices are rigidly traditional, their standard of intelligence may be low, money is scarce or even absent, and their crops are raised in small holdings, often subdivided to an almost incredible degree. I once had occasion to acquire 17 acres for expansion of an agricultural research station in India and found 30 families and 91 individual plots represented in this piece of arable land. In such conditions and they are those under which a great part of the population of the world lives—"the cultivator's ways and the sheep's ways tend to be much the same", as an Indian proverb says, and however well the traditional agricultural methods are followed, the cultivator is apt to be helpless in an emergency as, for example, an outbreak of epidemic plant disease.

It is not surprising that the earlier plant pathologists who worked in the tropics, from the time when Marshall Ward went to Ceylon in 1880 to fight coffee leaf disease when it was already too late to save the industry from ruin, should have concerned themselves mainly with the diseases of the great export crops. A study of the reports of fifteen or twenty years ago will show that for practical purposes, India was the only tropical British possession in which it was the policy of the Agricultural departments to devote much of their attention to the crops grown by the people of the country for their own use. During the past ten years, however, there has been a considerable improvement in this respect in the British colonies, especially those of tropical Africa Most of the colonies have one, and a few have two. plant pathologists attached to the Agricultural departments and whereas in several of them there are no plantation of crops, the needs of the village cultivators are receiving attention. Even in some of the more advanced 'plantation' colonies such as Ceylon and Malaya, the large plantation industries have now organised their own research departments, leaving the Government departments of agriculture free to concentrate on the improvement of the local crops and methods of farming.

Such improvements are likely to increase the responsibilities of the plant pathologists. New and improved varieties of crop plants are liable to become attacked by diseases from which the old ones had become immune through age-long selection, and more intensive methods of farming often have a similar result. The great activity in crop improvement that has been characteristic of agricultural development in the United States and Canada since the beginning of the present century, has been accompanied by such an increased call on the services of plant pathologists that each of the staple crops has, not one but many men engaged in the study of the cause and control of the diseases to which it is liable. As similar efforts are made to improve the staple food crops of the tropics similar needs will be felt. There are clear indications from the work on rice in Japan that even in a crop such as this, which in India is one of the healthiest of all the field crops there are a number of diseases capable of becoming formidable obstacles to the introduction of improved varieties.

The two tropical cereals next in importance as food crops, sorghum and the bulrush millet, are much more subject to disease than rice, but very little work has been done on them in the tropics and even the full life history of several of the common bulrush millet parasites is unknown. Still less is known of the diseases of the tropical pulses and other plants of economic importance except those that are grown for export. Tropical plant pathology has not much to boast of in the study and control of village and field crop diseases; the number of many years of work put into this branch of Agricultural science is too small to have yielded much result and the difficulty of getting the native cultivator to change his ways, as well as his lack of means and general backwardness, has helped to induce a pessimistic outlook amongst those who are charged with the control of agricultural research and amongst the research workers themselves. Nevertheless, not only because there is great preventable loss of crops from disease in the tropics but also because a solid knowledge of the pathology of each crop plant is a necessary concomitant of all attempts at crop improvement, means must be found to surmount these difficulties. Little by little, openings for successful attack on them will appear, and however slow progress may be at first, the next fifty years are bound to see a great improvement in the crops and in the general agriculture of even the most primitive of the African colonies. In this advance plant pathologists will have to bear an ever increasing share.

The work which has been done in India during the past twentyfive years or so illustrates some of the problems that the tropical pathologists have to face in dealing with village and field crops. When the Indian agricultural department was formed thirty years ago extremely little was known of the diseases of tropical plants, though there were a few exceptions, such as sugarcane. The first work done in the mycological branch, therefore, was to make a survey of the diseases of the more important crops, and when many of these were found to be undescribed, a more intensive study of a few was undertaken and lasted a number of years. Two of them, one on palmyra and cocoanut palms and the other on rice, broke out in epidemic form and had to be dealt with on emergency lines, invoking the aid of the administrative services and leading in the palm disease campaign, to legislation of the kind that is familiar in more advanced countries, where it becomes an actionable offence to own a diseased plant without reporting or dealing with it as prescribed. In the campaign against this disease, which was exterminating the palmyra in an area where this was the dominant tree and by far the most useful, nearly a million diseased palms were cut out to save the rest. This and the subsequent legislative action and the discovery that many trees could be saved by removing the bud sheaths in the early stages of attack have been successful in preventing the spread of the disease and in keeping it within manageable proportions. The campaign cost the Government about £ 20,000; but the value of the palms cured by treatment was estimated at about £ 28,000 in 1921, and the number saved from infection must run into millions.

In other cases it soon became evident that the variety of the crop grown was exceptionally liable to disease either because of inherent susceptibility or because disease had been allowed to accumulate in the stock and was being transmitted when diseased material was used for planting each successive crop. In such cases the agriculturists of the department, each of whom had a district under his charge, became invaluable collaborators, both in observing the injury done to particular varieties and in introducing new or more healthy ones.

Then there were the cases where one had to make a direct attack on the parasite and try to kill it or to prevent its spores germinating by the use of fungicides. This at once brought one face to face with the economic limitations of village agriculture in countries like India, where the cultivator usually has little actual money at his disposal and can only borrow at exorbitant rates of interest.

Copper and sulphur have remained to the present day the chief weapons in the hands of the plant pathologists in their direct attack on fungal parasites. In India they have been used chiefly on the more valuable orchard and garden crops or as seed disinfectants on field crops.

The relative infrequence of destructive epidemics of disease amongst indigenous crops in the tropics as compared with the great plantation crops is not due. I think, as is sometimes assumed, to the circumstance that the latter generally occupy larger continuous areas under the one crop, so that disease germs can multiply and infect more readily. In India there are large areas of village lands mainly under a single crop as rice in 70 per cent of the cultivated land in parts of Bengal or cotton in 60 per cent of Khandesh. Freedom from disease in these cases is probably mainly due to disease resistance having become, through long experience, the determining factor in the selection of the varieties grown, the quality of which is liable to be a secondary consideration and is often decidedly low. In the plantation industries, on the other hand, quality which will enable the produce to compete in the markets of the world is so important that hardiness may be sacrificed. Examples of destructive epidemics in these crops are numerous and are not, as in the other category, usually due to newly introduced parasites. They are just as often due to an old parasite finding in a new variety a congenial host They are sometimes also due to the considerable financial return leading to expansion of a plantation system into areas not naturally affording optimum conditions for the growth of the plant, so that its environment may become more favourable to the parasite than the host.

The recent wave of epidemic disease that has ravaged the cotton plantations of the Sudan may perhaps find a partial explanation in these considerations. When the great Gezira irrigation scheme, due in its inception to the genius of Garstin and Kitchener, was opened in 1925, it was already established that the highest quality Egyptian long-stapled cotton could be successfully grown in this previously arid waste. At the present time approximately, 200,000 acres of irrigated Sakel cotton is grown as the major crop in the gigantic plantation of 600,000 acres under uniform control and cropping, surely the largest arable farm in existence. During the first five years after the dam was built across the Blue Nile, cotton worth more than £ 12,000,000 was produced from the Gezira, and 150,000 people had settled where before there was only a scattered famine-stricken population.

The cotton disease known as blackarm occurs in all the cotton growing parts of Africa, but it seldom causes much injury to the varieties grown by the people of the tropical regions, and the long stapled kinds grown in Egypt escape damage apparently because the climate of Egypt does not suit the parasite. In the Egyptian varieties grown in the Sudan it became a formidable pest, being one of the main factors in reducing the yield per acre from 479 lb in 1925–26 to 129 lb. in 1930—31. This represents a loss of more than 60,000,000 lb. of cotton on the area grown in the latter year, worth even at the low prices then prevailing, more than £800,000. As the disease is carried mainly on the seed, an elaborate scheme of seed disinfection with the dust known as 'Abavit B' was carried through before the last season's crop was sown, the whole of the seed for this great area, representing more than 30,000 bags, being treated by specially devised seed dusters. Various other steps were also taken to combat the disease, and the yield, when harvest was completed last spring, was found to have risen again to a little more than 400 lb. per acre, or not far short of that of the earlier years.

In this case there is far more at stake than the saving of an industry, however important. The whole future of a province is in the balance. I cannot refrain from quoting a foreign observer who visited the Sudan two or three years ago. 'The Sudan is the latest thing in European exploitation and it is the best." There has been "created a corps of agriculturists and entomologists to destroy the pests that attack the native crops: a group of veterinarians to look after and to improve the native cattle; and a quite unrivalled body of biologists, bacteriologists, laboratory workers and doctors to fight native diseases. Trekking through the land are the Government biologists and entomologists, experimenting, destroying pests, noting processes, giving advice You rarely find them in the same place for two weeks running; these hardy scientists do even more work in the open than in their laboratories".

The West Indies present a very different picture from the Sudan. There, in some of the oldest of the British colonies, generations of planters and settlers have been engaged in the tropical and subtropical cultivations of lands favoured by Nature to an unusual degree. Jamaica is the largest banana exporter of the British colonies, having sent out 24,000,000 bunches in 1930, representing more than 50% of the total value of her exports In 1912 the first cases of the now notorious Panama disease of bananas in the island were examined by S. F. Ashby. Rigid quarantine measures were promptly introduced by the Director of Agriculture, Mr. H. H. Cousins, impressed by the ruin from this disease which had befallen the banana growing enterprise in the Dutch Colony of Surinam between 1906 and 1910. As soon as a diseased plant was discovered, it and all the surrounding ones on an area of four chains had to be destroyed and the area fenced in. As a result, spread was slow, the number of cases annually not surpassing 1000 until 1921. Increase since has been at the rate of about 50 per cent a year, until by 1929, there were about 85,000 cases, involving nearly 140 000 plants in the parish of Portland, the most diseased, some 9000 acres, or approximately one-tenth of the total estimated banana acreage of the island, have now been abandoned, for it has been found that commercial banana growing is impossible on land once infected, and the great United Fruit Company has already abandoned nearly 100,000 acres from this cause in Central America. The expenditure by the Government of some £ 60,000 in Portland no doubt prolonged the life of the plantations by ten years or more, but in the end has proved unavailing.

As there is no direct method of fighting this disease which is due to a soil fungus, attempts to procure resistant varieties are being energetically carried out both in Jamaica and at the Imperial College of Tropical Agriculture in Trinidad. Varietal tests have shown that the Cavendish species of banana and some others are either highly resistant or totally immune. Botanists both from Kew and the West Indies have toured the world in search of varieties for trial and hybridisation and these are grown under quarantine and inspection at Kew before being sent on to Trinidad. Very large numbers of crosses have been made in Trinidad and Jamica and some of the immune seedlings produced in the latter island have given bunches which were acceptable to the trade during the past year. The Trinidad seedling I.C.1. (Imperial College No. 1), a cross between the commercial Gros Michel and a wild species has also shown remarkable immunity during six years tests, but the fruit still requires improvement.

It is estimated that within the next five to seven years at the present rate of increase of the disease and the amount of suitable banana land left, the Jamican export will begin to decline, and the decline is likely to be rapid unless a satisfactory resistant variety can replace the Gros Michel. The breeding work is difficult and slow. It is not easy for the stricken farmers to be patient. The whole population in the coastal parts of the parish of Portland has been brought up to the cultivation of the banana before anything else, and though an alternative crop of marketable value is desperately needed, it will take a long time to break down prejudices in a one crop population. Many of the people have migrated, but many have remained to make a living as best they can. It is cold comfort to tell them, as there have not been wanting even scientific men to say, that these coastal lands, extraordinarily fertile though they be, are unsuited to the banana because the damp soil favours attack by Panama disease. The local Department of Agriculture has never taken that view but has striven hard to fight the disease, and the extra lease of life that it has given the industry, though insufficient in Portland, may yet save the banana cultivation of the island as a whole.

In the examples selected to illustrate the importance and control of the diseases of tropical plants, there is every gradation in severity from the sorghum smut which levies a moderate toll of about ten per cent of the crop on some millions of acres in India, to the Panama disease which completely exterminates the susceptible bananas and precludes replanting within any reasonable time. The success of the measures which have been adopted to control these diseases also shows every gradation from the complete control which is easy to obtain by disinfection against sorghum smut or by growing Cavendish bananas in Panama diseased land, to mere alleviation which appears to be all one can hope for, but is yet sufficient, against rubber mildew or the root diseases of limes. A consideration of these measures—ruthless eradication, the complete replacement of susceptible varieties, hybridisation or selection to obtain resistant plants, budding or grafting on resistant stocks, modifications in agricultural practices like stubble burning or pre-watering, and finally, the direct attack on the parasite by steeping, spraying, or dusting— indicates how varied is the task of the plant pathologist and how wide must be the foundations of his knowledge if he is to perform it successfully. The old conception of the Mycologist, student of the fungi that cause disease as adequately equipped to fulfil the duties of a plant pathologist, dies hard but it is dying. Like bacteriology in the realm of medicine, pure mycology is a necessary foundation and the mycologist a necessary collaborator, but he is not equipped either as a general practitioner or a specialist in particular diseases.

The practical man is often slow to admit that a destructive disease in a plant is due to agencies outside his control. Confronted with such he is inclined to seek for explanations other than the true one. He looks first for some disorder brought about by cultivation or inbreeding, or meteorological phenomena. Or he thinks that the soil is unsuitable or has become exhausted, or that the plant, if an exotic, has failed to become acclimatised. It is often not until all these have been tested and found wanting, that the true cause is fully realised. Experience has shown that it is unfortunately rare to find the explanation of serious disease in these directions and the dominating factor is usually the presence of a parasite, however much its activities may be favoured by secondary causes.

Failure to recognise the very varied weapous used by modern plant pathology and undue weight given to the secondary factors in the causation of disease have led, no doubt, to the suggestion which I have heard that the "mycologist", as he is still called in most of the British colonies, may be in danger of losing his position a one of the most essential members of any team of tropical research agriculturists. In actual fact there can be no question that, looked on as a member of a team and relying on the collaboration that must exist between him and the plant breeders and agriculturists the plant pathologist is more needed now than ever. Improvement in the crops of the people and the quest of quality or the satisfaction of market fancies in the plantation crops can be relied on to be followed by increase in disease. Unless plant pathologists well-versed in the pathology of the crop concerned are available—and they cannot be produced at a moment's notice—the examples I have given will be paralleled in every Colony in the British Empire.—(*Nature*, 24—12—'32.)

THE LATE DR. C. A. BARBER

In the death of Dr. C. A. Barber which took place recently, the world of Science and especially that group of pioneers in agricultural and plant breeding work in India, has lost a very valuable and distinguished member.

Charles Alfred Barber was born on the 10th November, 1860 at Wynberg in South Africa. When eleven years old, he was sent to England and had his early education in a grammar school at Bath, for six years. In 1878 he entered as a clerk in a District Bank in Newcastle-under-Lyme, and passed through his five years' apprenticeship. Meanwhile he carried on his studies in science privately and passed the London University B. Sc., with honours. In 1883 he proceeded to Germany with the idea of devoting his time entirely to science and was in the famous University of Bonn for a year, and during this period he specialised in Botany and had the privilege of being a student of Professor Strasburger and other famous botanists of that University In 1884, Barber returned to Christ's College, Cambridge, and as a student secured the place of a demonstrator in Elementary Botany. Gradually he was able to secure a teacher's place and carried on his University studies as well. In 1889 he took the Cambridge Natural Science tripos Part II, in the first class and became demonstrator in Botany at the Cambridge University. In 1891 he was appointed as Superintendent of Agriculture, Leeward Islands, West Indies After his work there for four years which gave him some experiences of the tropics, he returned to England and became instructor in Botany at the Royal Institute of Engineers at Coopers Hill.

It was in 1898 that Barber left Coopers Hill and landed in India to take up the appointment of Government Botanist, Madras, and with it the Directorship of the Botanical survey of South India In this dual capacity he had facilities to tour about the province and make extensive botanical collections and get a close acquaintance with the flora and agricultural conditions of South India. His botanical work gradually brought him in touch with economic problems connected with agriculture and his activities had to be diverted to the study of crops in their various aspects. As one who was responsible for starting the experimental Farms at Samalkota, Palur and Taliparamba for the study of special crops, he laid the foundations for the newly organised Madras Agricultural Department. Very useful work continued to be done at Samalkota, Palur, and Taliparamba in the study of sugarcane, groundnut and pepper and all the present output of work on these crops has been built on the systematic foundations laid by him.

For his research work on various items and especially for that on the *haustoria* of the sandal he was awarded the Doctor's degree in

THE LATE Dr. C. A. BARBER, M.A., D.Sc., C.I.E.

Science by the Cambridge University in 1907. In 1908 Dr. Barber joined the new Agricultural College at Coimbatore as the Government Economic Botanist and Professor of Botany and until the appointment of a Mycologist and an Entomologist, he also supervised the work of the Indian assistants in these Departments. In 1912, Dr. Barber was appointed Sugarcane Expert for India and continued in this appointment until he retired in 1919. The work of Dr. Barber as Sugarcane expert and breeder at his sugarcane farm in Coimbatore has gained international fame and we need no more endorsing testimony to his valuable work than the numerous varieties of canes that he has handed over to the Indian cultivator and which are grown everywhere. As a recognition of the valuable scientific work he did, the Government honoured him with a C. I. E. in June 1918. It is needless to state that he has published numerous papers in botany, agriculture and sugarcane work and it is difficult to enumerate them in this brief sketch. And it was only very recently that Dr. Barber gained for his work in sugarcane the Maynard—Gangaram prize of a substantial amount. As a scientific worker Dr. Barber had few equals; his accuracy, clarity, and systematic arrangement of work were features which were inimitable and unique. Those among the officers of the agricultural department who have had the privilege of working with him can never forget the splendid training in both scientific and administrative work which they received from him. In fact, several officers holding responsible places in the agricultural department at present, owe their early training in scientific work to the valuable organising and training capacities of Dr. Barber, and we are sure they cannot forget it; they are all "sparks from my anvil" as Dr. Barber himself used to say. We cannot refrain from stating that Dr. Barber was a man possessed of very high scientific attainments and organising capacities and it is very rare to meet with one of such remarkable qualifications.

In his private capacity, Dr. Barber was a very perfect gentleman with very pleasant and suave manners. He was a good sportsman, and right up to his retirement and even in his retired life he was maintaining his status as a first class tennis player.

In conclusion, we may add that the Madras Agricultural Department was very fortunate in getting the valuable services of such a person as Dr. Barber, for carrying out the pioneering work in placing this department on a secure and scientific foundation; and as long as the department and the College continue, the name of the late Dr. Barber can never be forgotten. Nor is it necessary to state that early steps will surely be taken by his admirers to perpetuate his memory in a very suitable manner.

(*Editor*).

Notes and Comments.

1. The Poona Agricultural College: In the recently issued report of the Bombay Government Re-organisation Committee, one among the many retrenchment proposals of the Thomas Committee is the abolition of the Agricultural College at Poona. To us, such a proposal comes as a terrible surprise ; for, at a time when the general cry all over the country is to divert our activities to agriculture, and 'go back to the land', such a suggestion is not only unexpected, but very unwise. To abolish an institution of the kind which is giving instruction in the most important occupation and industry of the country, is a retrograde step of a very high degree. The College of Agriculture at Poona, is one of the premier scientific institutions in India which has been, and is training up young men for various agricultural careers, and it will be a great pity if the Government of Bombay accepts the views of the Retrenchment Committee, and closes this very useful and popular institution. It is also an irony of fate, that this curious suggestion to close the college should emanate at a time when the Silver Jubilee of the Institution has just been celebrated ! We must record our emphatic protest against such a policy which is in the very face of it, a case of false economy.

2. The late Dr. Barber : We very much regret to announce the death last month, of Dr. C. A. Barber for many years connected with the Madras Agricultural Department. Readers might remember that in our January issue we made a reference to a letter received from Mrs. Barber regarding the unfortunate condition of her husband, but we were not prepared for this sad news following so closely We offer our sincerest condolences to Mrs. Barber and her two children on this sad bereavement, and hope that it will help them bear the sorrow, to know that they have the deepest sympathies of many friends and well-wishers in India, who have known them, and who have worked with the late Dr. Barber in the Madras Agricultural Department. As a humble tribute to perpetuate his memory we are adding a short biography of Dr. Barber which would be instructive and inspiring to many of our young readers.

3. Fruit Culture in Mysore : The Mysore State appears to have started on some substantial lines of research in fruit growing and horticulture, as may be seen from the Government review on the recent administration report of the State gardens in Mysore. The State Government is anxious that special efforts should be taken to develop fruit industry on promising lines; with this idea, they have called for a Research Scheme on fruit culture from the Superintendent of Gardens in consultation with the Director of Agriculture. It is well known, that Mysore has been more or less the pioneer in starting pomological work, and has been importing and growing stocks of various tropical fruit trees, especially, in and around Bangalore. The State nurseries have, it appears, imported from Australia over five-thousand fruit plants, consisting chiefly of apples, oranges, and grapes. As hinted in our last month's note, this is a good sign of the times when people have begun to appreciate the value of fruits in human dietary, and the consequent desire to grow more and better fruits.

4. **World's Grain Exhibition**: A world's grain exhibition and conference is to be held at Regina in the Dominion of Canada, during July-August 1933; the prize money offered for the best exhibits of grains amounts to £25,000. The Ministry of Agriculture and Fisheries in England is arranging to inspect and certify the samples from England and Wales, before they are despatched to Regina. Besides England and Wales, other European countries like Italy, Portugal, France and Belgium are also participating in the exhibition competitions. In addition to the exhibition, there is to be a conference of experts from every grain-producing country in the world, with the object of pooling knowledge on every phase of production and marketing. The British Government are expecting to send a delegation. We understand that in this country, arrangements have been made by the Imperial Council of Agricultural Research, to send the best samples of grain produced in the country. Samples of rices, cholam, (*sorghum*) ragi (*Elusine coracana*) are being got ready even in Coimbatore, for despatch to the exhibition. We do hope that the Imperial Council of Agricultural Research may find it possible to send some delegates from India to take part in the conference.

5 **The Plight of Tanjore Rice Merchants**. Due to various difficulties -especially the competition of Burmah and Circars rice in Ceylon and in the West Coast, combined with the very unfavourable steamer and railway freights—rice merchants in Tanjore are now finding it very hard to secure a favourable market for their delta products, in the West Coast markets as before; and many of the mirasdars in the Tanjore delta are in a very unfortunate plight. To make proper enquiries into this matter, and to suggest means for removing the existing difficulties and providing better marketing facilities, the Madras Government has deputed the Joint Registrar of Co-operative Societies to proceed to Tanjore, and make personal investigations; on his arrival, a meeting was arranged of the leading mirasdars and the Collector, and the special officer discussed the matter at some length. Some of the suggestions offered to the special officer were:— (1) reduction of railway freights by S. I. Ry, (2) the reopening of old ports like Tranquebar and Port Calimere to facilitate transport of rice to Jaffna, (3) the extension of the Vedaranyam railway line to Point Calimere and (4) affording banking facilities and credit system to merchants. It is hoped that the Special Officer may be able to find some possible ways and means and be able to ease the situation.

6. Twenty years' Index for the M. A. J. We invite the attention of our readers to the fact that a complete and exhaustive index of the first twenty volumes of our Journal (1911—1930) has been compiled and is being got printed by the Union. It is hoped that it will facilitate easy reference to all the various papers and other contributions that have appeared in the Journal during the last twenty years. Copies will be ready very soon and at the suggestion of many friends the price has been fixed at a low rate of Re. 1—4—0 per copy and to those who register their applications before April at Re. 1.

7. A New Sugarcane Farm in Chittoor. We gladly welcome the news that the Finance Committee of the Madras Legislative Council have sanctioned the proposal of the Development Department to acquire 30 acres of garden land and 3 acres of dry land in Chittoor, for a sugarcane farm the experiments therein to be conducted by the Madras Agricultural Department, from out of a grant by the Imperial Council of Agricultural Research. In view of increased import duty on foreign sugar, the expansion of areas under sugarcane locally, has assumed very great importance, and experimental stations for carrying on research on this important crop, as to the best and most economic methods of cultivation, pertaining to conditions of each tract, are an absolute necessity. The experimental station at Anakapalle could but serve the needs of the Circars, and work at this newly proposed farm at Chittoor, will furnish information that could be availed of by cultivators in the central Districts, where the conditions are different from those in the Circars, and where the chief problem is one of lift irrigation and the consequent wasteful irrigation practices. It is true that the central districts grow only a fifth of the total area under sugarcane in the Presidency, but the opening of this farm, will serve to stimulate cultivators owning land under tank irrigation, to increase their area under sugarcane, which compared to other provinces is becoming a neglected crop in our Presidency.

ABSTRACTS

Effect of varying moisture conditions on the growth of rice in typical light, medium and heavy soils of the Central Provinces.—D. V. Bal and R. N. Misra (*Nagpur Agricultural College Magazine, 1933, vol. 7, No. 3, pp. 109–112*). Previous work of the authors had shown (*Agriculture and Live-Stock, India, 1932, vol. 2, pp. 404–416*) that the rice crop showed a better growth in heavy soil not submerged under water than when kept submerged under water in the usual way. The present paper reports the results of pot culture experiments carried out during the years 1929, 1930 and 1931 to test the effect of varying moisture conditions on the growth of rice in three typical soils of the Central Provinces, viz. (a) light rice soil (Matási soil; silt 40%, clay 18·4% water holding capacity 30%); (b) medium rice soil (Dorsa soil; silt 24%, clay 40%, water holding capacity 43%), and (c) heavy rice soil (Kanhar soil; silt 13%, clay 53%, water holding capacity 54·3%). Quadruplicate pot experiments, under manured and unmanured conditions, carried out during the three years, showed that:— (1). In the case of light

soils, submerging the soil under water, acted beneficially and gave as good yields as when the water was added from time to time when necessary. (2). In the case of medium soils, submerging the soil under water gave lower yields than when water was added by instalments, and the difference was about 10 to 20%. (3) In the case of heavy soils, there was a serious decrease in yield amounting to about 50 to 75%, when the soil was kept submerged under water. If on the other hand, water is added to such soils from time to time to keep them at the maximum water holding capacity, a normal yield equal to that of light soils was obtained.

(C. N.)

Silage investigations at Bangalore. IV. Ensilage of Jowar Straw :— T. S. Krishnan (*Agriculture and Live-Stock in India. 1932, vol. 2, part vi, pp. 619-626.* Cf. M. A. J. *Vol. XXI pp. 41.*) Jowar (*Sorghum vulgare*) is raised extensively in many parts of India as a fodder crop. In varieties where the grain is used for human consumption, the stalks left over are used as cattle fodder. As the straw consists of tough stalks and a few dried leaves and is not relished by cattle, the author has examined the effect of silaging the straw, on its palatability and nutritive value. Before ensilage, enough water was added to the straw to bring down the dry matter content to about 25%; the mass was kept ensiled in a pit 12 ft long, 6 ft. wide and 8 ft. deep from December to May. At the end of the period, a silage of uniform quality, having a dark-brown colour and a good soft texture and a pleasant slightly acidic smell was obtained, which might be classed as good "acid brown silage". It was eaten with great relish by cattle. Feeding experiments conducted with the silage so prepared give very favourable results. Comparison of the chemical composition of the silage with the original straw showed a loss of about 10% on the dry matter, an increase in ether extractives from 1·68% to 2·11%, being mainly due to increase of volatile organic acids, a decrease in the Nitrogen free extract and mineral matter to the extent of about 20% on the original content There was also an increase of volatile bases and decrease in amino-acids. The changes were in general in the same direction and of the same magnitude as during the ensilage of Jowar in the prime condition (when earheads just harden), except in the case of the proteins, where there was a smaller amount of decomposition with straw silage (12%) than with the prime stage-silage (30%). The author concludes that subjecting Jowar straw to the process of ensilage should prove of considerable help in the better utilisation of this stuff. (C. N.)

An experiment on Mineral Assimilation from two typical fodders — F. J. Warth A. Viswanatha Iyer and N. Krishna Iyer (*Indian Jour, Vet. Sci. 1932, Vol. 2, part 4, pp. 325-332*). Recent work in the field of animal nutrition has emphasised the great importance of the mineral constituents of feeding stuffs, and as it is likely that the problem of minerals may be acute in India, especially in areas which have been cultivated for a long time and also in regions where the soil is exposed to excessive leaching, the authors have, by way of preliminary work, made a comparative test of two typical fodders, viz. *Ragi* straw and *Bolarum* hay, from the mineral standpoint. The samples of *Bolarum* hay used in the experiment, contained on the average 0·834% of lime, 0·078% of phosphoric anhydride and 0·459% of nitrogen, while *Ragi* straw contained 1·136% of lime 0·193% of phosphoric anhydride and 0·511% of nitrogen. The fodders were poor in nitrogen and seriously deficient in phosphoric acid as compared with English fodders. In the present experiment a long period feeding test was carried out with the above two fodders, four bullocks being maintained on each, and a small defined amount of concentrate being fed to all animals alike to maintain the nitrogen balance. The feeding test was divided into the three following main periods. 1st period: the fodder without mineral supplement; 2nd period: fodder with supplement of calcium phosphate; 3rd period: fodder with supplement of calcium phosphate and green food. The object of adding green food in the last period, was to test whether increased assimilation of the minerals was brought about by the addition of vitamins in the green food. During each period, numerous determinations of the mineral balance were made. With regard to *Ragi* straw, it was concluded that it was well provided with lime, since appreciable assimilation took place in the first period. The phosphoric acid appeared to be on the border line of sufficiency. The animals on this ration were evidently not suffering from lime shortage, yet in the second period when a mineral supplement of calcium phosphate was added, there was a further very large assimilation of lime, indicating the probable influence of phosphoric acid on lime assimilation. With regard to the hay ration, the experiments showed that this fodder was seriously deficient in phosphoric acid. The interesting fact was noted that even under extreme shortage of phosphoric acid, the faecal losses amounted to 10 gm. a day indicating this to be the limiting factor. In the present experiment, green grass did not show any noticeable increase in assimilation of the mineral constituents. The authors, finally stress the practical significance of their results and the importance of maintaining the necessary phosphorus supply of mature working bullocks, especially in the slack-season when concentrates are not fed. (C. N.)

Distribution of Soil Moisture after Irrigation :— A. R. Shaw (*Hawaii Planters' Record, 1932 Vol. 36, pp. 73–90*). The object of the investigation was to ascertain the nature of moisture distribution in the soil after different intensities of irrigation. Furrows with ridges 12 to 16 inches high and rows 5 inches apart from crest to crest, were filled with amounts of water corresponding to 1·34, 2·0, 4·0 etc. acre-inches of water and after 48 hours, trenches were dug across the rows to observe the extent of penetration of the water. The actual values obtained varied with the nature of soil type and method of irrigation (contour, long line or border method), but the results showed that, in general, after a light irrigation in a normal loam soil, the wetted area extends laterally to some distance on both sides of the furrow and is of moderate depth. With heavier applications of water, the lateral spread of moisture through the soil does not increase appreciably, but the vertical penetration increases nearly in proportion to the quantity of water used and much may be lost if the irrigation is heavy. There was no evidence to show that in a well drained soil there is any appreciable movement of moisture from wet to dry soil by capillary attraction. (C. N.)

A comparative study of Corn and Molasses as Basal feeds for Swine :— D. R. Gochangco. (*The Philippine Agriculturist, 1933 Vol. 21, No. 8, pp. 560–571*). The object of this study was to determine and compare the feeding value of molasses and corn as basal feed (a) for growing pigs, and (b) for gilts for breeding purposes. 21 Berkjala weanlings and 14 gilts were used in the experiments which ran over a period of about 7 months; and the rations consisted of rice bran 60 parts; copra meal 18 parts; and shrimps 2 parts together with either corn 20 parts or molasses 20 parts or a mixture of corn 10 parts plus molasses 10 parts. The results showed :— (1) In the mixture of feeds used in these experiments, for growing pigs and gilts, one part of molasses was equal to one part of corn in feeding value. (2) Molasses should be substituted partly or wholly for corn, especially when the latter becomes scarce or the price high. (3) To prepare an animal for show purposes, molasses appears to be a better feed than corn, as it imparts more readily plumpness, smoothness and refinement in the general appearance of the animal. (C. N.)

Infestation of Stored Products by Insects :— J. W. Munro, (*Nature, Jan. 21, 1933*). Prof. J. W. Munro of the Imperial College of Science and Technology has contributed an article in Nature (Jan. 21,1933) on the above subject. The article summarises the results of study of the scientific problems underlying infestation of stored products by insects and fungi, done at the special laboratory of the

Imperial College started in 1927 with the grant provided for the purpose by the Empire Marketing Board. The work is divided into three sections: survey and intelligence work at the London docks, research and experimental work in the laboratory, and commercial scale experimental work on sterilisation of infested produce and warehouses in London and other ports.

A survey work of the insects associated with cocoa, dried fruits, spices and tobacco stored in London warehouses showed that upwards of 140 species of insect are represented, though only a few of them are of prime importance. The main results of the survey work have shown that in nearly all—if not all—instances, infestation begins in the exporting country and that it is aggravated by storage in Great Britain.

The laboratory research and experimental investigations in progress comprise entomological, mycological and chemical work. In the entomological branch, the problem studied is concerned mainly with the rearing of very large numbers of insects for experimental work, on such lethal agents as heat, cold and fumigant gases, and with various problems relating to the respiration of insects in different stages of development.

In the chemical section of the laboratory, research and experimental work on the relative toxicity of various fumigants to insects and on the partial vapour pressures of fumigant vapours and gases generally used in admixture have been carried out and awaits publication. According to Prof. Munro, it is found that in the fumigation of ships, warehouses, mills and produce as practised commercially, no serious attempts are made to determine the behaviour of gases used during the actual process of fumigation. It appears that the concentrations of fumigants as are recommended or employed in practice are based on experimental work in which the kind and extent of living insect material used are quite inadequate. In the experience of the Professor, five, ten, or in rarer cases, thirty insects which are considered ample for experimental work are far too small and in the commercial work done by the Professor he was not satisfied with the results unless 2 to 4 thousand insects reared or produced under known conditions were subject to such experimentation. A study of the behaviour of gases during fumigation has shown that temperature effects are not allowed at all, the very high absorption of fumigants by the products themselves is altogether underestimated, and quite inadequate measures are taken to ensure proper diffusion and distribution of the gas. The most important direct contribution to the 'control' of insect infestation that has been made by this special laboratory is in directing attention to these defects and providing means of overcoming them.

Efficient fumigation is not, however, the final aim of the work at this laboratory because the ultimate reduction of the losses caused by insect infestation of stored produce depends on the acquisition of a fuller knowledge of the insects concerned than is possessed at present. Subjects on which promising research work is being conducted as time and funds allow are the temperature and humidity conditions—both in the atmosphere and in the product—which are most favourable to various insects, and the relationship of the mould-causing fungi to the insects' food supply. (K. R).

Gleanings.

Synthetic Quinine Substitute. Recent work at the University College of Science, Calcutta, has been carried out in an endeavour to synthesise a compound which might replace quinine, the production costs of which are very heavy. It is now reported that Professor H. K. Sen and Professor W. Basu have obtained a substance in the laboratory which on testing has been found to be a good substitute for quinine. Whilst having the same antiparasitic value, it has the advantage of not producing the side-effects associated with quinine, and the taste in water is not so bitter The compound is an ammonium salt obtained in work on coal-tar derivatives, and it is stated to be moderately soluble in water. (*Chem. and Industry*, 1932, Vol. 51, P. 884).

Science—Fundamental and applied. What the ordinary citizen so often fails to realise is the part which fundamental scientific research (exemplified by that performed at the universities) and applied technical research (exemplified by that performed by the industries themselves and by such agencies as the Department of Scientific and Industrial Research) is *already* playing in maintaining him with some degree of stability and comfort in that state of life which he has reached. Nor does he properly appreciate the crash—industrial, political, and social—which would necessarily follow the neglect of opportunities to acquire new knowledge of material resources and new power to use them.

It is the business of scientific men and women to explain to others the position as they know it and the future as they see it. To-day it is more necessary than ever before that they should strive to show the voter that research is not merely the concern of the capitalist who uses it to safeguard his possessions; not only the concern of the employer whom it helps to use services and materials to the best advantage; not only the servant of the worker, the conditions of whose labour have, in many cases, been improved out of all recognition: but also the benefactor of the poor, into whose homes it brings much that was formerly reserved for the rich; and the chief hope of the unemployed, whose chance of a job depends so much on the development of new industries, Where industry and research are concerned, we are indeed all 'in very much the same boat'. The bigger and the better we can make that boat, the happier and the safer we shall be. (Extract from '*Nature*, No. 3293. Vol. 130, pp. 862–863'.)

Toothpaste Facts and Fancies. In spite of what the advertisements say, it's the tooth-brush that cleans your teeth; the tooth paste is of negligible importance, according to S. M. Gorden and E. W. Shard of the American Dental Association Bureau of Chemistry. The merits of the different brands of toothpaste are mostly confined to the imaginations of the men who write the advertisements, say these two chemists, for all toothpastes are mostly calcium carbonate or phosphate, soap and flavouring. Recent work of the Bureau, reported in "Industrial and Engineering Chemistry ' was undertaken to check up on the claims of one tooth paste advertiser to the effect that his product has a low surface tension—the inference being that thorough brushing of the teeth is unnecessary. Just work up a lather in the mouth and the penetrating foam with its low surface tension will penetrate into the crevices between the teeth and remove every particle of debris lodged there. The investigators found that there is not enough difference in the surface tension of various toothpastes to distinguish one from another, and they intimate that even if there were, it would not mean any thing as far as the actual cleaning of teeth is concerned. (*Scientific American*, January 1933).

Absolute Alcohol. Removing water from alcohol to produce " Absolute alcohol " has been a tedious process and many attempts have been made to dehydrate alcohol more cheaply and easily. In Germany, this has been achieved by the use of an azeotropic distillation process in which benzol or gasoline is added to form a ternary system with alcohol and water. In the upper part of the rectifying column, a ternary mixture of alcohol, benzol and water, boiling lower than alcohol is distilled off, whereas in the column itself, absolute alcohol remains. The ternary mixture is then allowed to settle into two layers, which in turn are used in the process again. This process which has already found considerable use, has been improved by the use of trichlor ethylene instead of the benzol or gasoline. The German state monopoly is using the process in six of its plants and obtaining a daily yield of 340,000 litres of absolute alcohol. (*Scientific American*, January 1933.)

Root Nodules and Nitrogen Fixation. As No. 5 in the University of Wisconsin Studies in Science has appeared a sumptuous volume upon the "Root Nodule Bacteria and Leguminous Plants", by E. B. Fred, I. L. Baldwin and Elizabeth McCoy. This monograph reviews critically and adequately the enormous literature dealing with this subject and contains also a very judicial summary of the attempts made upon a commercial scale to supply the causal organism of the nodules to farmers. It is interesting to read the conclusion that nitrogen fixation in pure cultures of the nodule organism outside the plant remains still unsatisfactorily established, though the gain in nitrogen from the air by the activity of the living contents of the nodule is beyond doubt. The authors point out that different types of nodule, with different distribution on the root system, may have different values. They conclude that the best results are obtained when the nodules are relatively few in number and large in size and borne on the tap root and the main laterals. A commonly accepted theory that comes out badly from this critical study is the view that the nodule is to be regarded as an abortive branch root. At the same time, the authors give little indication of the manner in which the vascular tissue develops within the nodule. They review briefly work upon root nodules on plants outside the *Leguminoseae* and also upon the few cases where bacteria are reported as regularly associated as symbionts with leaves. In this review the root nodules of *Casuarina* receive very brief notice but Aldrich-Blake now publishes a note (Oxford Forestry Memoirs, No. 14, 1932) which would add *Casuarina equisetifolia* to the list of plants in which growth is materially improved when nodules are produced on the roots as the result of infection by a mixture of crushed nodules and soil. (*Nature*, No. 3299, Vol. 131, Jan. 21, 1933).

World's Best Yielder: Lady Pride Pontiac Lienwkje, a registered Holstein cow owned by F. E. Murphy, publisher of *The Minneapolis Tribune*, has broken the world's record for combined milk and butter in a 365 day test just completed. This cow produced 35,626 lbs of milk and 1483 lbs. of butter in the year test. The dam of Lady Pride, while not a world's champion, ranked as one of the highest two year olds of her time with a record of 860 lbs. of butter and 20,825 lbs of milk, and was a grand-daughter of K. P. Lilith Clothilde, a former world's champion with 1043 lbs. of butter and 22,229 lbs. of milk as a four-year old (Minneapolis Tribune, July 1932, quoted in the *Philippine Agriculturist*, January 1933).

Effect of an Iodine fertiliser on Iodine content of food plant. Owing to the possible therapeutic value of iodine containing foods some interest attaches to the preliminary experiment on the effect of an iodide applied to the soil on the iodine content of turnips. White egg turnips were grown under uniform conditions, except that one half the plots received potassium iodide at the rate of two kilograms per hectare, while the other plots received a chemically equivalent amount of potassium chloride The potassium salts were applied in the row. The yield of roots and tops was slightly, but not significantly higher with the chloride than with the iodide. However, the small amount of iodide added produced significant differences in the iodine content of the turnips. The iodide treated plants contained 441 and 950 parts per billion of iodine in the roots and tops, respectively, against 165 and 441 parts in the chloride-treated plots. Whether these quantities of iodine in food have therapeutic value is not known to the writers, but the experiment indicates the possibility of large relative increases in iodine content of root crops by the application of iodides. (*Science*, Vol. 76 No. 1981, Dec. 16, 1932.)

A new use for Cellophane. It is sometimes convenient to make records of a permanent nature which can be reproduced on a screen by an arc lamp projection lantern. This can be accomplished in a very simple way at very low cost. Briefly, it is a method of typing on cellophane

Cellophane is placed upon the carbon side of a sheet of carbon paper, which is placed in a typewriter with a backsheet to protect the rubber roll. Next the typewriter ribbon is adjusted the same as in the making of stencils. The letters which are produced in this way are dark and sharply defined. If a permanent record is to be made, the cellophane is placed between two pieces of glass cut to the size of projection lantern plates. If some discarded lantern plates are available, place them in water for a short time and then the emulsion can be scraped off. The pieces of glass are then sealed around the edges with mending tape. If the record is not of a permanent nature, the cellophane can be used between the plates without the necessity of the plates being sealed.

In making a graph the procedure is the same, with the exception that the graph is drawn on the cellophane with a pencil. The pencil will not mark, but a clear record is obtained from the carbon paper.

Care should be exercised in handling the cellophane, as the completed work can be rubbed off with the hands.

This method has proven satisfactory in the reproduction of the words of songs for chapel exercises and in the making of blueprints and in the drawing of graphs and diagrams to be used during an illustrated lecture when it is impossible to have the use of a blackboard or when a blackboard is not available. These are a few of the uses to which this work is adapted. (*Science*, Vol. 76, No 1981, Dec. 16, 1932)

Crop and Trade Reports.

MADRAS PRESIDENCY

Cotton, raw in the Madras Presidency, 1932. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1932 to 31st January 1933 amounted to 437,376 bales of 400 lbs lint as against an estimate of 423,610 bales of the total crop of 1931-32. The receipts in the corresponding period of the previous year were 333,546 bales. 325,153 bales mainly of pressed cotton were received at spinning mills and 118,016 bales were exported by sea while 38,346 bales were imported by sea mainly from Karachi and Bombay. (*From the Director of Agriculture, Madras*).

Cotton Crop Madras, 1932-33—Fourth Report. [On an average of the five years ending 1930-31, the area under cotton in the Madras Presidency has represented 8·9 per cent. of the total area under cotton in India.] The figures in this report relate to the cotton crop sown between April 1932 and January 1933 (Estimates up to the 25th January 1933.) (1). The area sown with cotton is estimated at 1,956,100 acres as against 2,175,700 acres for the corresponding period of last year. There has been a decrease of about 10 per cent. (2). Two hundred and twenty-eight thousand five hundred acres have been reported as sown since the last December forecast was issued. This extent is made up of 87,200 acres of Tinnevellies, 52,000 acres of Cambodia, 42,000 acres of Northerns and Westerns, 30,200 acres of Salems and 17,100 acres of Cocanadas. The area sown in December and January is less than that sown in the corresponding period of the previous year by 169,700 acres or about 43 per cent. (3). The decrease in area occurs in all districts outside Vizagapatam, Nellore, South Arcot, Salem and Trichinopoly. The decrease is marked in the Deccan (—212,100 acres). It is due partly to unfavourable seasonal conditions and partly to the preference for groundnut.

The area under irrigated cotton, mainly Cambodia, is estimated at 190,700 acres as against 161,900 acres for the corresponding period of last year, an increase of about 18 per cent. (4) Picking of the mungari or early sown crop in the Deccan is over. The yield was below normal due to drought in the growing period. The crop is coming into the market. Normal yields are expected in all districts outside the Deccan and Nellore. The hingari or late sown cotton has been affected by drought and the crop is expected to yield only 85 per cent. in Bellary and Anantapur. (5). The seasonal factor for the Presidency works out to 95 per cent. of the average as against 92 per cent for the corresponding period of last year. On this basis, the yield works out to 420,000 bales of 400 lb. lint against 430,300 bales for the corresponding period of last year. It is, however, too early to estimate the yield with accuracy as the harvest has not yet commenced in the major portion of the area and much will depend upon the future weather conditions and toll taken by insect pests. (6) The wholesale price of cotton lint per bale of 400 lb. as reported from important markets towards the close of January was Rs. 80 for Cocanadas and red northerns, Rs. 88 for white northerns, Rs. 87 for westerns (mungari crop) Rs. 108 for Cambodia, Rs. 100 for karunganni cotton, Rs. 87 for nadam cotton and Rs. 97 for Tinnevellies cotton. *(From the Board of Revenue, Madras.)*

Madras Paddy Crop Final Report 1932-1933 (On an average of the five years ending 1930-31, the area under paddy in the Madras Presidency has represented 13·3 per cent of the total area under paddy in India. The figures in this report relate to the paddy crop sown between February 1932 and January 1933.) (Estimates up to the 25th January 1933.) The area sown with paddy in 1932—33 is estimated at 11,582,000 acres as against 11,609,000 acres for the corresponding period of last year and the finally recorded area of 11,537,000 acres in 1931--32. The present estimate exceeds the final area by about 0·1 per cent and the area in an average year by about 3·7 per cent. 2 One million two hundred and seventy thousand acres have been reported as sown since the last December forecast was issued. The extent sown was large in East Godavari, West Godavari, the Carnatic (345,000 acres), Chittoor, North Arcot (160,000 acres), Trichinopoly and the South (307,000 acres). The area sown in December and January is greater than that sown in the corresponding period of the previous year by 21,000 acres or about 1·7 per cent. The area under second crop paddy is expected to be normal generally. 3 The harvest of the main crop outside the Circars is in progress. Normal yields are expected in all districts outside Vizagapatam, East Godavari, West Godavari, Kurnool, Chittoor, North Arcot, Trichinopoly, Tanjore and Tinnevelly. The crop is expected to yield only 85 per cent of the normal in West Godavari owing to the attack of insects and fungoid pests. The seasonal factor for the Presidency works out to 97 per cent of the average as against 99 per cent in the season and crop report of last year. On this basis, the yield works out at 104,748,000 cwt. of cleaned rice as against 107,792,000 cwt. estimated in the season and crop report of last year. The yield in an average year is estimated at 105,170,000 cwt. 4. The wholesale price of paddy per imperial maund of 82 2/7 lb. as reported from important markets towards the close of January ranged from Rs. 1—4—0 to Rs. 1—6—0 in Tanjore, Trichinopoly and South Arcot, and Rs. 1-12—0 to Rs. 2—4—0 in the other districts. *(From the Board of Revenue, Madras.)*

ALL INDIA FORECASTS:

Rice crop of 1932-33. The total area reported is 82,026,000 acres, as compared with 84,260,000 acres in the previous year; The total yield is estimated at 30,655,000 tons of cleaned rice, as against 32,988,000 tons in 1931-32. The decrease is 3% in area and 7% in yield. The condition of the crop is, on the whole reported to be fairly good. But the crop was very much affected in Bihar and Orissa and in the United Provinces by insufficient rains. The average yield per acre works out at 837 lbs. as against 877 lbs. in 1931-32, 871 lbs. in 1930-31 and 865 lbs. both in 1929-30 and 1928-29. The average percentage of the area under rice in the different provinces on the total all-India area under rice for the five years ending 1930-31, and also the provincial acre yields are given below—Bengal 24% and 961 lbs. per acre; Bihar and Orissa—16·7% and 912 lbs. per acre; Burma 15·1% and 749 lbs. per acre; Madras 13·3% and 1045 lbs. per acre; United Provinces 8·7% and 676 lbs. per acre; Central Provinces and Berar 7·3% and 710 lbs. per acre; Assam 5·4% and 774 lbs. per acre; Bombay 4·2% and 1026 lbs. per acre. The total quantity of rice (both in the husk and not in the husk) exported from British India to foreign countries by sea during 1932, was 2,142,900 tons of which Burma contributed 1,883,700 tons, Bengal, Bihar and Orissa 152,400 tons and Madras, Bombay and Sind 106,800 tons. The principal foreign countries to which exports were directed were the United Kingdom (138,800 tons), Germany (176,400 tons), Ceylon (396,100 tons), China (443,900 tons) and Netherlands (75,500 tons). The coastwise exports from Burma to Indian ports were 940,500 tons. Advices from foreign rice growing countries show increase of area and yield in Formosa, Siam, Japan, and Java, and decrease of yield in the United States, Italy, Korea and Cochin China. (*Abstracted from the Indian Trade Journal, Feb. 23, 1933.*)

Groundnut crop of 1932-33. The total area returned is 6,952,000 acres, as compared with 5,489,000 acres in 1931-32 or an increase of 27 per cent. The total yield is estimated at 2,836,000 tons of nuts in shell, as against 2,276,000 tons last year, or an increase of 25 per cent. The condition of the crop, on the whole is reported to be fairly good. The contributions of the different provinces for the All-India, crop are as follows:— Madras, area 3,494,000 acres, 53·7 per cent. of total area, yield 1,631,000 tons, yield per acre 1,046 lbs. Bombay (including the Indian states), area 1,666,000 acres, 20·4 per cent. of total area. yield 684,000 tons, acre-yield 997 lbs. Hyderabad, area 1,118,000 acres, 8·7 per cent of total area, yield 320,000 tons, acre-yield 641 lbs. Burma, area 492,000 acres, 9·1 per cent. of total area, yield 157,000 tons, acre-yield 715 lbs. Central Provinces and Berar, area 182,000 acres, yield 41,000 tons, acre-yield 542 lbs. The total quantities exported by sea to foreign countries during the nine months April to December 1932, were 275, 700 tons; as compared with 475,200 tons in the corresponding period of 1932; the principal exporting provinces were Madras (215,500 tons) and Bombay (60,100 tons) and the importing countries were France 112,600 tons, Germany 20,500 tons and Netherlands 32,300 tons. (Abstracted from *the Indian Trade Journal, Feb. 23, 1933*).

Castorseed crop of 1932-33. The total area reported is 1,581,000 acres, as compared with 1,583,000 acres last year. The yield is estimated at 116,000 tons as against 145,000 tons last year. The condition of the crop on the whole, is reported to be good. The position of the different provinces is as follows:— Hyderabad, area 838 000 acres, 44·4 per cent of total area, yield 61,000 tons, acre-yield 163 lbs; Madras, 334,000 acres, 23·1 per cent. of total area, yield 35,000 tons, acre-yield 235 lbs; Bombay, area 116,000 acres, 8·5 per cent. of total area, yield 19,000 tons, acre-yield 367 lbs; Mysore, 111,000 acres, 8 per cent. of total area, yield 6,000 tons, acre-yield 121 lbs; Baroda 78,000 acres, 7·8 per cent. of total area, yield 7000 tons, acre-yield 201 lbs; Bihar and Orissa, 52,000 acres, 3·6 per cent. of total area, yield 8000 tons, acre-yield 345 lbs; Central Provinces and Berar, 38,000 acres, 3·4 per cent. of total area, yield 7000 tons, acre-yield 413 lbs. The quantities exported by sea to foreign countries during the nine months April to December 1932, were 68,200 tons, as against 91,300 tons during the corresponding period of the previous year. The chief exporting provinces were Bombay (42,700 tons), Madras (22,300 tons), and the importing countries were, the United States (23,200 tons) the United kingdom (16,900 tons) and France (11,900 tons). (Abstracted from *the Indian Trade Journal, Feb. 23, 1933.*)

ASSOCIATION OF ECONOMIC BIOLOGISTS.*

Under the auspices of the association Mr. D. G. Munro, Deputy Director of Agriculture, VIII Circle gave a lecture on "The Potatoes in Nilgris". Mr. G. N. Rangasami Ayyangar, President of the association, occupied the chair.

To begin with, the lecturer gave a brief outline of the history of potato cultivation, how it was first introduced into England in 1587, the several visicitudes it had undergone, and the origin of most of the varieties cultivated at present. The crop was first introduced into India in the 17th century and tried in a great many of the hill stations in North India and also in Nilgris. So far as Madras was concerned the bulk of the potato area was confined to the Nilgris which from 730 acres in 1875 had now increased to over 11 thousand acres. Mention had been made in some of the early records of seedlings having been raised, but none of them appeared to have stood the test. Even in Punjab where some seedlings had been raised locally, none of them was found to compare favourably with the imported ones. The main work on potatoes was now centred in the importation of varieties and selection of the best of them for local cultivation.

He then mentioned about the phenomenal increase in the area in Nilgris during the war time due to a demand for export and the favourable increase in prices. In addition to the increase in the area, which had nearly doubled during the war time, the use of artificial fertilisers had also contributed to the increased output so that, the produce from the Nilgris was at present four times the quantity produced before the war.

The total area under potato in Nilgris, the lecturer stated might be divided into

1.	Irrigated crop	Jany.	May	200 acres
2.	Main crop	Apr	Sep.	6,600 „
3.	Second crop	Sep.	Dec.	33,000 „

The uneven distribution of the area among the three crops was stated to have introduced difficulties with regard to seed supply. The irrigated crop which has to supply seed for the second crop is too small to supply the required quantity of seed that the ryots are obliged to lift the main crop early, keep the produce for a month and then plant it for the second crop. Even then the planting sometimes gets delayed and the crop gets caught in the December frosts.

The experience at the Nanjanad research station has been that it was not possible to rotate potato with any cereals due to the high acid nature of the soils. This is, however, being counteracted by the application of large doses organic matter and lime, and this is expected to ulimately reduce the present high cost of cultivation He then dealt in detail the estimation of the produce prevalent in the tract as so many times the quantity of setts used This estimation was very unsatisfactory as it depended on the size of the setts planted. Ryots usually plant about 8 bags (1 bag is 80 lb.) of setts to the acre, the size of the setts being 1 oz. and less. If however the setts were bigger, more would have to be planted so that there could be no relation between the quantity of setts planted and the quantity of produce obtained. Certain experiments conducted at the Research Station has thrown light on the point, as will be seen below:

Size of sett planted	Yield of produce in relation to seed used.	yield per acre, mds.
1 oz.	9·9 times	325 „
2 „	5·1 „	395 „
2 „	5·2 „	430 „
3 „	4·0 „	517 „

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* Report of a meeting held on 17th February 1933.

So according to the ryot's method of computing the yield, the yield obtained by planting 1 or 2 oz. setts was greater than from planting 3 oz. setts although, it is the planting of the latter that has given the heaviest yields. The planting of bigger setts also showed another advantage in that they could be planted wider apart. The practice adopted at Nanjanad was to have the rows 2 to 3 feet apart with the seeds planted 9 to 12 inches apart in the row.

The lecturer then briefly described the different varieties of potatoes grown in the Nilgris, the two most important of them being Kidney and Great Scot. These two varieties have the advantage of sprouting early. Besides work on varieties there have been experiments going on with regard to suitable methods of cultivation and manuring. It has also been found possible to keep down the incidence of disease by adopting systematic rotation. The manurial experiments have clearly pointed out that a mixture of farmyard manure and artificials give better results than either of them applied alone. A mixture of groundnut cake, sulphate of ammonia, and steamed bone-meal in definite proportions is now being applied on a basal dressing of dung and this has greatly increased the yields obtained. The average yields which were 2·48 fold before, have now gone up to 5·85 fold since the introduction of systematic manuring, better cultivation and better rotations. The ryots, however, are still relying chiefly on artificials which they apply sometimes at the rate of 3 to 4 tons to the acre. Very little trouble is taken to collect the available farm yard manure and use it for the potato crop. It has been demonstrated at Nanjanad that it is possible by practising judicious methods of conserving, nearly 6 tons of manure could be obtained per head of cattle in a year. There are, however, two disadvantages with the farm yard manure namely 1. the diseased and rotten potatoes which are usually thrown in the manure pit might help in the dissemination and spread of the disease when the manure is applied to the soil, and 2. the manure being bulky difficulty is experienced in its transport to the field all by head loads along foot paths.

The Imperial Council of Agricultural Research has now sanctioned funds to undertake research work in potatoes. When the scheme is given effect to, the lecturer hoped to undertake regular breeding work and supply of good seed to the ryots in addition to the cultural and manurial experiments that have been going on.

At the close of the lecture, several of the members and students applied to the lecturer for additional information on various points raised in the lecture to all of which he suitably replied. With a vote of thanks to the lecturer proposed by the president the meeting came to a close late in the evening. (K. R.)

College News and Notes.

Games. Hockey—The Parnell cup. The interclass hockey tournament for the Parnell cup provided more than passing interest. Each class played the other classes twice and the championship was well contested. In their first match, class iii beat class ii by one goal but in their second encounter the game ended in a pointless draw. In their first match against class i, class iii sustained a defeat by one goal, but in their second meet they avenged their defeat and won convincingly by a margin of 3 goals. Thus class iii who secured 5 points against 4 of class i and 3 of class ii, annexed the cup.

Tennis. In the American sealed handicap doubles tournament the entries totalled 36. The results proved to be a very keen contest, the scores made by the winners (Venkata Sastri and Murugesan) being 174 games against 173 of the runners up (Radhakrisna Rao and Joseph) and 172 of the pair (Ananda and Veeriah) which won the third rank.

Cecil Wood Cup. The annual singles tournament for the Cecil Wood cup was won by Moncey Joseph of class i, who beat Ananda of class ii in the finals.

College Colours. The College colours for the year were awarded as follows:— *Cricket.* U. Narasinga Rao, (class i) S. Varadarajan (class iii) and K. M. Narayanan (class iii); *Football.* Bennet Massilamony (class ii); *Tennis.* Moncey Joseph (class i).

Athletics. The annual conference of the Madras Agricultural Students' Union having been postponed, the athletic sports run under the auspices of the Union did not take place this year but the Students' club rightly took up the responsibility of running the sports. The sports were held on Saturday the 11th March and the results of the competition were as follows :—

100 Yards dash. (1) A. M. Kulandai, (2) S. Varadarajan, (3) Mohomed Obeidulla Shah.
High Jump. (1) K. M. Narayanan. (2) S. Varadarajan (3) N. Muthuswami.
Shot Put. (1) Mohomed Obeidulla Shah, (2) B. Suryanarayanamurthi.
Long Jump. (1) K. M. Narayanan, (2) Mohomed Obeidulla Shah, (3) Sam Joshua.
Quarter Mile. (1) A. M. Kulandai, (2) Sam Joshua, (3) Nagarajan.
Throwing the cricket ball. (1) Sahadevan. (2) K. Lakshmanan.
Javelin throw. (1) Narayana Pillai, (2) Srirama Reddy.
Mile Race. (1) D. Satyanarayana, (2) K. Lakshmanan, (3) Balakrishnan Nair.
Kicking Foot ball (1) N. Muthuswami, (2) B. Suryanarayanamurti.
Sack Meele. (1) A. M. Kulandai, (2) K. M. Narayanan.
Slow Cycle Race. (1) S. Varadarajan, (2) P. Satyanarayana.
Three-legged race. (1) Narayanan and Varadarajan, (2) Kulandai and partner.
Pick-a-back race. (1) Govinda Panikker and partner, (2) Sam Joshua and partner.
Blind man's Buff. (1) Arunachalam, (2) Panikker.
Sack race. (1) Krishna Menon, (2) Panikker.
Wheel Barrow race. (1) Kulandai and partner, (2) Panikker and partner.
Musical chairs. (1) Seshagiri Rao, (2) Kulandai.

The winners of tournaments in the indoor and outdoor games were as follows:— *Chess* (1) Rajan, (2) B. S. Murti; *Ping-pong* (1) Ananthanarayanan, (2) Muthuswami; *Draughts* (1) Doraiswami, (2) K. Krishnamurti; *Badminton Fives* Class ii; *Badminton doubles* (1) Class ii, (2) Class i; *Volley ball* Class ii; *Basket ball* Class iii.

Elocution Contest. The annual elocution competition of the Student's Club was held on the 15th March. Mrs. Jesudass, M.A., L.T., Mrs. Karunakar, B.Sc., Rev. Edmund Bull, Chaplain of Coimbatore, Rao Bahadur T. S. Venkatraman, and Rao Bahadur C. Tadulinga Mudaliar formed a committee of judges, the subject announced being "The position of Indian Agriculture in 1983." The first, second and third places were awarded to Messrs. Y. V. Narayanayya, F. L. Daniel, and D. C. Hanumantha Rao respectively.

The Students' Club Day. The students' club Day was celebrated on the 18th March with great *eclat* when a long and varied programme was gone through. The proceedings began at 4-30 p.m. with a meeting in the Freeman hall under the presidency of Dewan Bahadur Sir T. Vijayaraghavachariar, K. B. E., Vice-chairman of the Imperial Council of Agricultural Research, who distributed the College prizes and medals to the winners. The prize winners for the year were as follows:—

The Robertson medal— R. Suryanarayana.

The Kees prize, The Clogstoun prize, and the Dewan Bahadur R. Raghunatha Rao prize—K. Bushanam.

The Anstead medal—N. Srirama Reddi.
The K. S. Venkatramier medal—S. V. Parthasarathy.
The certificate course cup and the D'Silva prize—M. Bhavani Sankar Rao.
The Goschen prize— B. W. X. Ponnayya.
The Cuddapah Dist. Agri. Association Prize— { T. Venkatarama Reddi
C. Krishnamurthi
R. Suryanarayana.

After the distribution of the prizes, the meeting adjourned for tea at which the students and staff of the college and a select company of guests from the town included in which were Sir and Lady Vijayaraghavachari. During tea the guests were entertained at a fancy dress parade at which about 20 costumes most of which were very original and fascinating took part. A committee of judges awarded marks to the competitors and prizes were awarded to the best three. After tea, the party adjourned to the hall where a variety entertainment was arranged. The chief features of the entertainment were magic, a farce in two scenes depicting the way to heaven, vocal and instrumental music, a Telugu dialogue, humourous recitations, the singing of the College Ode specially composed for the occasion and the reading of the Hostel Chronicle'. All the items were thoroughly appreciated and they revealed wide and varied talents among the students. The sports prizes, College colours, prices for fancy dress competition and elocution contest and the trophies and prizes for the various tournaments were then given away by Mrs. Kamala Patel the wife of Dr. J. S. Patel, Oil Seeds Specialist. The winners were lustily cheered and with a vote of thanks by the Principal the pleasant function came to a close.

Literary activities. A meeting of the students' club was held on the 28th February when Mr. P. Parthasarathy of class iii spoke on "Fruit culture--its future." Another meeting was held on the 3rd March when Mr. G. N. Rangaswami Ayyangar delivered the valedictory address. The lecturer paid a glowing tribute to the College which was imparting education of a very high standard and utility. He exhorted the students on the spirit of service for which they were eminently suited by their training.

Week end tours: On the 25th and 26th the students of class iii went to the Nilgiris on a week end tour and visited the Government Botanical Gardens at Ootacamund. Sim's Park and Pomological station at Coonoor and saw the Burliyar and Kallar fruit stations on their way down the ghat. Another tour was arranged for the same class on the 13th March to Mettupalayam. Both the tours were very enjoyable and instructive and much information was collected regarding agriculture of the hills.

Excursions. The residents of the colony were afforded several opportunities for sight seeing and relaxation from the routine monotony of the desk and field, by a number of excursions arranged during February and March. A party visited Valparai (Anamalais) and another went to Mettur to see the construction of the Dam in progress. Under the auspices of the Association of Economic Biologists a trip was arranged on the 19th March to visit the Siruvani water works.

Activities of the Upper Subordinate Officers' Association. 22 upper subordinates completed their probation on 19th August 1931, four days subsequent to the date of operation of the G. O. barring confirmations. The D. A. has been requested to condone the 4 days of uncomplete referred to and to confirm them in the old scales of pay.

The D. A. has also been requested to fill up vacancies now existing in the III and IV grades and to get a larger number of posts sanctioned in the higher grades to relieve stagnation in the various grades. G. O. No. 542 of 8—4—32 bars the promotions where the grade, lower or higher, from or to which respectively promotions is sought is in a time scale of pay and the promotions to III and IV grades is limited by this rule. The Government have been approached accordingly to suitably modify the G. O.

The Association has reiterated the following resolution of the Madras Secretariat N. G. Officers Association and has submitted it to Government—

'That the Government be requested to be so good as to set apart the amount realised from the pay cut from 1—12—31 to 31—3—33 and constitute it into a separate fund for the purpose of granting gratuities to officers of the Provincial and Subordinate services who retire from service and to the families of officers who die in service and to work out a scheme for the purpose.'

Weather Review (FEBRUARY—1933)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	...	- 0.7	0·5
	Berhampore *	...	...	0·6
	Calingapatam	...	-0·5	...
	Vizagapatam	...	-0·8	0·1
	Anakapalli *	...	-1·9	...
	Samalkota *	...	-0·5	...
	Cocanada	...	-0·2	0·4
	Maruteru *	...	...	...
	Masulipatam	...	-0·4	...
	Guntur *	...	-0·8	...
Ceded Dists.	Kurnool	0·3	+0·1	0·3
	Nandyal *	...	-0·2	...
	Anantapur	0·1	...	0·1
	Bellary	...	-0·1	...
	Hagari *	0·2	+0·1	0·2
	Cuddapah	...	-0·1	...
Carnatic	Nellore	...	-0·1	...
	Madras	...	-0·3	...
	Palakuppam *	...	-1·2	0·1
	Palur *	0·1	-0·4	0·1
	Cuddalore	...	-0·8	...
Central	Vellore	...	-0·3	...
	Salem	...	-0·3	...
	Hosur Cattle Farm *	...	...	...
	Coimbatore	...	-0·4	...
	Coimbatore Res. Inst. *	...	-0·5	...
	Trichinopoly	...	-0·6	...
South	Negapatam	0·6	...	1·8
	Aduthurai *	0·8	+0·6	0·8
	Madura	...	-0·4	...
	Pamban	0·2	-1·0	2·1
	Palamkottah	1·1	+0·2	1·1
	Koilpatti *	...	-0·8	0·1
West Coast	Trivandrum	0·1	-0·5	0·1
	Cochin	1·0	+0·3	1·0
	Pattambi *	...	-1·0	...
	Calicut	...	-0·1	...
	Taliparamba *	...	...	...
	Nileshwar *	...	-0·2	...
	Kasargode *	...	-0·4	...
	Mangalore	...	...	...
Mysore and Coorg	Chitaldrug	0·3	+0·1	0·3
	Bangalore	0·3	+0·2	0·3
	Mysore	0·4	+0·2	0·4
	Mercara	...	...	...
Hills.	Kodaikanal	1·2	-0·1	1·4
	Coonoor	0·6	...	2·7
	Kallar *	0·4	-3·7	3·4
	Ootacamund *	0·1	-0·8	0·3
	Nanjanad *	...	-0·6	0·3

Stations marked with an asterisk are stations of the Agricultural Dept.

General Weather. Weather was generally dry throughout the month, with a few scattered showers in the extreme south. Western disturbances traversing Upper

India had very little influence on the weather beyond causing an increase of cloud in the north. Rainfall was generally below the average except in Mysore and parts of Deccan and West Coast. Temperature was normal.

Weather Report for the Research Institute Observatory:

February 1933. Report No. 2/33.

Absolute maximum in shade	94·0°
Absolute minimum in shade	60·2°
Mean maximum in shade	91·5°
Departure from normal	+ 1·5°
Mean Minimum in shade	65·7°
Departure from normal	+ 0·4°
Total rainfall	nil.
Departure fom normal	—0·46"
Mean daily wind velocity	1·5 M. P. H.
Departure from normal	—2·0 M. P. H.
Mean humidity at 8 hours.	67·9 %
Departure from normal	—3·4 %
Total hours of bright sunshine	280·5
Mean daily hours of bright sunshine	10·0

General Weather: Weather was dry throughout the month. Day and night temperatures were slightly above mormal, while rainfall and humidity were below normal. Air movement was weak and for the greater part of the month, off the anticyclonic ridge of high pressure to the north. P. V. R. & T. S. L.

The Ramasastrulu—Munagala Prize, 1933.

1. The prize will be awarded in July 1933. 2 The prize will be in the form of a Medal and will be awarded to the member of the Union who submits the best account of original research or enquiry, carried out by him on any agricultural subject. 3. The subject matter shall not exceed in length twelve foolscap pages type-written on one side. 4. Intending competitors should notify the Secretary of the Madras Agricultural Students' Union not later than the 15th May the subject of the paper which they propose to submit and the paper should be sent in so as to reach the Secretary, Madras Agricultural Students' Union not later than the 1st June 1933, with a covering letter showing full name and address of the sender. The author's name should not be shown on the paper but should be entered under a nom de plume. 5. Four type-written copies of the essay should be sent in. 6. The name of the successful competitor will be announced and the prize awarded at the time of the Conference. 7. Papers submitted will become the property of the Union and the Union reserves to itself the right of publishing all or any of the papers. 8. All references in the paper to published books, reports or papers by other workers must be acknowledged. 9. Any further particulars may be obtained from the Secretary, Madras Agricultural Students' Union, Lawley Road, P. O., Coimbatore.

Departmental Notifications.

I Circle. D. Hanumantha Rao, A. D. Razole, l. a. p. on m. c. for 20 days from 20—2—33 to 11—3—33. A. Rammohan Rao, A. D. Rajahmundry extension of l a. p. on m. c. for 15 days in continuation of leave already granted. **II Circle** *Transfers*- J. Suryanarayana, F. M., A. R. S. Guntur to be A. D. Vinukonda. A. K. Annaswami Iyer, F. M., A. R. S. Guntur to be A. D. Kandukur. P. Gopalaratnam, Assistant in cotton, Cancelled his l. a. p. from 5th to 11th February. K. Ramanujachari, F. M. Guntur, l. a. p. for 15 days from 11—2—33 to 25—2—33. P. Satyanarayana, A. A. D. Kavali, l. a. p. on m. c. for 15 days from 27—2—33 **III Circle.** A. Krishnaswami Iyer, A. D. Koilkuntla, l. a p. for three weeks from 6—2—33. K. Balaji Rao, A. A. D. Tadpadri is put in charge of the Vans from 30—1—33 for tour in the Bellary District. P. Subrahmaniam, A. D. Siruguppa, l. a. p. for 5 weeks from 10—2—33 A. Venkobacharlu A. A. D. after the expiry of leave is posted to Dronachelam with headquarters at Dronachelam and is granted l a. p. for one month and two days from 29—1—33 on m. c. A. Krishnaswami, A. D Koilkuntla extension of l a. p. without m. c. for three weeks in continuation of leave already granted. **IV Circle.** A. Ramaswami Iyer, A. D. Villupuram extension of l. a. p. on m. c. for three months in continuation of leave already granted R. Narasimhachari, A. A. D. l. a. p. for one month and 12 days from 1—3—33 with permission to suffix the holidays from 13th to 19th April 1933. **V Circle.** S. Mahadeva Iyer, A. D. Ariyalur. extension of l. a. p for one month in continuation of leave already granted. T. K. Balaji Rao, Assistant A. R. S. Aduturai, l a. p. for 30 days from 20—2—33. V. G Dhanakoti Raju A. D. extension of l. a. p. for three months on m. c. in continuation of the leave already granted **VI Circle.** K. Krishnan, A D. Tinnevelly l. a. p. on m. c for six weeks from 6—2—33. T. S. Venkataraman, A. D. Palni, l. a. p for 4 months on m. c.. D. Shanmuga Sundaram is transferred to Palni. **VII Circle.** K. Achuthan Nambiar, A. D. in Mycology, l. a. p. for 2 months from 3—2—33. P. A. Kunhiraman Nambiar, A. A. D. Perintalmana l. a. p. for 14 days from 24—2—33 to 9—3—33 P. Narayanan Nambiar, A. A. D. l. a. p. for 13 days from 20—3—33. **Principal's Office.** C. Narasimhachari, Lecturer in Chemistry l a. p. for 13 days from 13—2—33. S. N. Chandrasekhara Iyer, Assistant Lecturer in Botany l. a. p. for one month from 6—2—33. M. Rathnavelu, A. F. M. l. a. p. for 16 days from 3—3—33. **Paddy Section.** S. Dharmalingam Mudaliar, Assistant, extension of l a. p. for 16 days in continuation of leave already granted. S. Ramanujam, Assistant, l. a. p. for 9 days from 30—1—33. A. Chidambaram Pillai, F. M. l. a. p. from 21st February to 17th March with permission to avail 18th and 19th March being holidays. **G. A. C's Section.** M. Sundaram, Assistant l. a. p. for 6 weeks from 20—4—33. **D. A's Office Orders.** K. Govindan Nair, Chemistry Assistant, Research Institute, Coimbatore, leave on half average pay for one year from 26—1—33. K. Veerabhadra Rao, Assistant in Chemistry, will continue to officiate. M. Damodara Prabhu, Upper Subordinate, Agricultural section, will continue as Upper Subordinate, Agricultural section, in the temporary post sanctioned. D. Shanmuga Sundaram, will continue to officiate till further orders in the permanent post declared temporary. M. J. David appointed as offg. Assistant V grade in the scale of Rs. 85—5—120 in the Mycology section till 2nd April 1933. The following officiating appointments of Upper Subordinates in the Agricultural Section, V grade in the scale of Rs. 85—5—120 are ordered with effect from 1st March 1933. K. Kumaraswami Chetty to officiate as A. D. Vice S. Viravarada Raju on other duty. S. Rajaratnam Chetty to officiate as A. D. Vice V. G. Dhanakoti Raju on leave. Muhamad Ali, to officiate as A. D. Vice A. Ramaswami Iyer, on leave. V. K. Appaji, to officiate as A. D. Vice P. S. Venkuswami Iyer on leave. L. Krishnan to officiate as F. M. A. R. S. Palur Vice V. Satagopa Iyangar on leave. H. Narahari Rao, A. F. M. Hosur, posted to

Samalkota for district work on poultry. P. Narayanan Nair, A. D. Dharapuram and M. Chinnaswami Naidu, A. D. Coimbatore, deputed for work connected with the irrigation experiments proposed under the Lower Bhavani Project from 20—3—33. Dr. C. T. George Asst. Ent. Section extension of leave without allowance for 1 month and 7 days from 11—3—33.

ADDITIONS TO THE LIBRARY

DECEMBER 1932.

A. Books.

1. Organisation of the wheat trade in the North-western Region—U. P. Prasad T. 1932. 2. An Economic Survey of Gijhi (Punjab Village Surveys No. 2) Narayan R. 1932. 3. Farm Accounts in the Punjab—1930-31. Kartar Singh S. 1932. 4. Cost of Milk Production at Lyalpur, Johnston, D. P. & Kartar Singh, S. 5. A. B. C. and X. Y. Z. of Bee Culture. Root, A. I & Root, E R., 1929.

B. Reports.

1. Madras Agri. Dept. Subordinate Officers Report for 1931-32. 2. Madras Agri. Dept, Administration Reports of the Agricultural Chemist, Entomologist, Mycologist, and Systematic Botanist for 1931-32. 3. Annual Report of the Madras Industries Department for 1931-32. 4. Season and Crop Report of the Madras Presidency for 1931-32. 5. Indian Weather Review—Annual Summary for 1931—Part A- Summary of Weather & Rainfall. 6. Annual Report of the Royal Agricultural Society of England for 1932. 7. Annual Report of the Florida Agri. Expt. Station for 1930-31.

C. Bulletins, Memoirs, etc.

1. Provisional Volume Tables and Diameter Growth Curve for Semal in the Central Provinces. *Ind. Forest Records Vol. XV Part V.* 2. Branch Smallwood Tables for Shorea robusta, Tectona grandis, Cedrus deodars, Pinus excelsa and P. longifolia. *Do. Vol. XV Part VI.* 3 Identification of Important Indian Sleeper Woods. *Ec. Series. Forest Bull No. 77-1932.* 4. Variations in the properties of the Cotton Fibre in relation to its position on the surface of the seed—(1) Fibre-length (2) Fibre-weight & (3) Fibre-strength. *Indian Central Cotton Committee Technological Bull Series B, No. 14.* 5. "Correction-slip" for the names of the more important trees and shrubs of the Madras Presidency. *Rept. from Mad. Forest College Magazine, Sept. 32.* 6. The Farmer's Guide to Agricultural Research in 1931. *Royal Agri. Soc. of England—Annual Publication, 1932.* 7. The Mitscherlich, Wiessmann & Neubauer Methods of Determining the Nutrient content of Soils. *Imp. Bur. of Soil Science Technical Commn. No, 25.* 8. A Simple System of Farm Book-keeping *Min. Agri. & Fish Bull. No. 58.* 9. Malayan Agricultural Statistics—1931. *S. S. & F. M. S. Dep. Agri. Econ. Ser. No. 1—1932.* 10. Preliminary List of Food Plants of Some Malayan Insects. *S. S. & F. M. S. Dep. Agri. Supp. to Bull. No. 38.* 11. Frozen Fruits and Their Utilization in Frozen Dairy Products. *Massachusetts A. E. S. Bull. 287 July 1932.*

D. Leaflets, Circulars, etc.

Ministry of Agriculture & Fisheries Leaflets. No. 144. Mutual Insurance of Live Stock-Cow & Pig Clubs. No. 146. The Valuation of Artificial Manures. No. 147. Phosphatic Fertilizers. *Cyprus Gazette—Agriculture Supplement No. 52.* Almond Growing in Cyprus.

E. Translations.

On the studies of drought resistance, morphological and physiological modifications and variations of yields for various soil-moisture contents in rice plant. By Onodera, J.

JANUARY 1933

A. Books.

1. Principles of Agrobiology or the Laws of Plant Growth in relation to Crop Production, Willcox, O. W. 1930. 2. The Soybeans. Piper, C. V. & Morse, W. J. 1923. 3. Land Drainage and Reclamation. Ayres, G. C & Scoates, D. 1928. 4. A Manual of Green Manuring. Ceyl. Agri. Dept. Pub. 1932. 5. Practical Hints on the making and Maintenance of Lawns in India. Sherrard-Smith W. 1931. 6. Practical Hints on Rose Culture in India. Sherrard-Smith W, 1932. 7. Practical Hints on Flower and Vegetable Culture in India. Sherrard-Smith. W, 1932. 8. The Agricultural Crisis-(2 Vols.) 1931. League of Nations Publication. 1931. 9. The Indian Peasant. Marquess of Linlithgow. 1932. 10. Industry and Trade. Marshell, A. 1927. 11. The Meaning of Money. Withers. H. 1930. 12. Hand Book of Commercial Geography. Chisholm, G. G. & Stamp, L, D, 1932. 13. Stocks and Shares. Withers, H. 1926. 14. Public Finance. Bastable C. F. 1927. 15. The Fundamentals of Statistics. Thurstone, L. L. 1928. 16. The Fundamental Principles of Taxation. Stamp, J. 1929. 17. Recent Advances in Cytology. Darlington, C. D. 1932. 18. Recent Advances in Plant Genetics. Sansome, S. W. & Philip (J) 1932. 19. Chromosome and Plant Breeding. Darlington, C. D. 1932. 20. International Address-Book of Botanists. Diels, S. & Merril, E. D. 1931. 21. Mendelism and Evolution, Ford, E. B. 1931. 22. Biology: An Introduction to the Study of Life. Fox, H. M. 1932. 23. The Scientific Basis of Evolution. Morgan, T. H. 1932. 24. The Causes of Evolution. Haldane, J. B. S. 1932. 25. A Revision of British Roses. Wolley-Dod, A. H. 1931. 26. Manual of Bacteriology, Muir, R and Ritchie, J. 1932. 27. Principles of Microbiology—2nd Edn. Waksman, S. A. 1931. 28. Ground Work of Biophysics. Wishart, G. W. 1931. 29. The Principles of Plant Biochemistry. Onslow, M. W. 1931 30. Colloid Aspect of Food Chemistry and Technology, Clayton, W. 1932. 31. The Glycosides. Armstrong, E. F. & Armstrong, K. F. 1931. 32. Soil Characteristics: A Field and Laboratory Guide, Emerson, P. 1925. 33. Organic Syntheses Vol. XI. 1931. 34. Organic Syntheses Vol. XII. 1932. 35. Organic Chemistry for Advanced Students. Part I. Reactions. 1928. Part II. Structure. 1931. Part III. Synthesis. 1931. Cohem, J. B. 1931. 36. A Comprehensive Treatise on Inorganic & Theoretical Chemistry. Vol. XII. Mellor, J. W. 1932. 37. Breeding and Care of the Albino Rat for Research Purposes. Greenman, M J. & Duhring, F. L. 1931. 38. A Manual of Bee-keeping. Wedmore, E. B. 1932. 39. Fundamentals of Insect Life. Metcalf, C. L. & Flint, P. 1932. 40. Laboratory and Field Manual of Economic Entomology. Eyer, J. R. 1932. 41. Methods for the Study of the Internal Anatomy of Insects. Kennedy, C. H. 1932 42. The Insect Menace. Howard, L. O. 1931. 43. Hydraulics. Lewitt, E. H. 1932. 44. Hydraulics for Engineers and Engineering Students. Lea, F. C. 1930. 45. Applied Mechanics. Low, D. A. 1931. 46. First Year Electrical Engineering. Bolton, D. J. 1929. 47. Accumulators: Charging Maintenance and Care. Camm, F. J. (N. D.)

B. Reports.

1. Annual Report of the Lalgudi Sivagnanam Co-operative Agricultural Society for 1931—32 (in Tamil). 2. Annual Report of Institute of Plant Industry, Indore for the year ending 30th June 1932. 3. Annual Report of S. S. & F. M. S. Agricultural Field Officers for 1931. 4. Annual Report of the Agricultural Department, Sierra Leone for the year 1931. 5. Annual Report of the Department of Agriculture, Tanganyika Territory for 1931. 6. Annual Report of the Agronomic Research Institute, Indochina for 1931—32 (in French).

C. Bulletins, Memoirs Etc.

1. Villagers' Calendar—1933 (Eng. Edn). *Madras. Agri. Dep. Pub.* 2 to 7. *Bombay Agri. Dept. Bulletins.* 162 of 1930 Papaya Cultivation in the Bombay Presidency

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A PHYSIOLOGICAL STUDY OF DELAYED GERMINATION IN COTTON

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Introduction : During the year 1930, a second generation of an interspecific cross, exhibited poor and delayed germination, while other crosses between different parents had uniform and quick sprouting. A large number of seedlings continued to come up even at the end of a month, often with their cotyledons enclosed in the seedcoat, in spite of the adequate moisture in the soil. These contributed very little to the yield, and their behaviour was very much similar to the second sown crop (*Plate II. Fig.* 2).

One of the criteria for a good and successful crop production lies in good and rapid germination followed by early growth. The disadvantages of a variety possessing delayed and protracted germination are many. It necessitates not only an initial high seed rate to ensure a good stand, but also forms a prospective nuisance in later years, as weed. Haphazard sprouting produces many weaklings which contribute very little to the yield besides delaying the general harvest of the crop.

The remarkable ability of certain seeds of cultivated and wild plants to remain viable for nearly half a century, even when lying buried in the soil, is a sufficient proof that dormancy is one of Nature's adaptations for securing longevity in seeds. The delay is in general more persistent in the wild types than in the cultivated races. The conscious selection pursued by man in his endeavour to domesticate and produce better varieties, has reduced to a minimum the rest period following a freshly harvested crop. Many of the present day cultivated varieties are marked by the complete absence of this quiescent period, and the continued presence of dormant seeds has been traced to both developmental and environmental causes.

Review of Literature: During recent years the enquiries have been centred round two main phases of the problem, viz., (1) the various methods by which dormancy is produced in Nature, (2) the exact conditions that are necessary for the maintainence of viability in seeds for a very long interval, and the conditions that force the germination of such seeds by modifying certain inhibiting factors.

The question of the influence of environment on the production of impermeability in seeds, has been debated for a very long time. A close relation between the moisture content, environment, and hardness has been noticed. Rose (1919) on Sambucus, and Toole and Drummond (1924) on cotton observed the onset of hardness when the moisture content of the seed fell below six per cent. Hiltner referred to by Croker (1919), and Bredeman (1931), found more hard seeds in dry periods and in dry climates. Jones (1928) concluded that the early vigour of the plant influenced the production of the hard seeds. It has also been found that the total water requirements of hard seeds are generally high. Guppy (1912), and Miazdticova (1932), showed that good permeable seeds required less water for germination than poor and delayed types. Youngman (1929), drew attention to the specific quantities of water needed for germination, and its relation to the climate under which each variety throve well.

The modes of securing this delay are varied and numerous, but they are generally found in the seed coat or the embryo. An interesting turn was given during recent years to this problem, as to the relative importance of these two plant parts in inducing the dormancy, but the volume of evidence adduced by numerous workers, point towards the seed-coat as playing a more important role. Ewart (1908) suggested a hypothesis that was incapable of experimental verification, that 'longevity depended upon how long the dry dormant protoplasm of the embryo was able to recombine and re-establish the molecular groupings of the proteid matter when remistened, and proceed with normal activity'. Crocker (1916) showed that 'loss of viability of seeds approaching air dry condition, is due to slow denaturing, or coagulation, of certain protoplasmic substances of the embryo'. The same author showed that delay in hard seeds might result from restricted absorption of water, low permeability to gases, or mechanical restraint by the seed-coat, or from rudimentary embryos.

Various substances in the seed-coat, and certain structural adaptations have been found responsible for the exclusion of water. Bergtheil and Day (1907), and Braun (1924), found the hardness was due to the presence of a thin cuticle. Jarzyomowski (1905), Coe and Martin (1920), Ohga (1925), Lute (1928), Reeves and Valle (1932), and Shaw (1932), each working with a different type of seed demonstrated that the light zone of the modified palisade, or the whole palisade layer of the seed-coat was of low permeability, on account of the reduced size of the lumina in these cells. The impermeability was to a large extent removed when the tips of the malpighian cells were broken by some mechanical means. Collins (1918) showed that there were restricted zones of absorption and transmission of water in barley, due to the structural peculiarities of the seed-coat Shull and Shull (1932) attributed the irregularities in the water intake of hard seeds to the non-homogeneity of the coat and the contents. Denny (1917) demonstrated the reduced water absorption due to the presence of pectic compounds, lipoids, and tannins. Harrington and Crocker (1923), and Verschaffelt quoted by Crocker (1916), found the micropyle closed in certain types of impermeable seeds.

Again the seed-coat sometimes limited the exchange of gases, and thereby induced delay. Crocker (1906), and Shull (1911), found that the exclusion of oxygen needed for the embryo, raised the minimum temperature necessary for the germination, and that high temperatures generally increased the rate of oxygen and carbon-di-oxide diffusion. Shull (1911), and Atwood (1914), obtained increased germinations under high oxygen pressures, or when the coat was opened. Kidd and West (1917, 1920) showed that the gaseous exchange was lower in a thick or unripe testa, and that a higher concentration of carbon di-oxide found in certain soils inhibited germination.

In other cases where the water entered the coat readily, but yet resulted in delay, the causes have been traced to the mechanical restraint of the seed-coat. Muller quoted by Crocker (1916), and Crocker and Davis (1914) with Alisma, found that the breaking strength of the water saturated seed-coat was considerably in excess of the imbibitional and osmotic pressures of the embryo at the time of germination. Harrington and Crocker (1923), and Ives (1923), obtained a better germination when the pericarps were removed.

Many of the seed-coat characters respond to the treatments, and the nature of the treatment greatly depends upon the nature of the defect. Rose (1915) has reviewed the various treatments with sulphuric acid, puncturing, and scarification. The existence of such mechanical treatments on a commercial scale for the herbage seeds on the Continent, is a sufficient proof for the better crops obtained with such treated seeds. The treatments primarily reduce the seed-coat thickness, and rarely alter its composition. Nye (1929) obtained a high and quick germination when treated with sulphuric acid. Dilute acids and bases act on the colloids of the seed-coat and increase their water holding capacity by dispersing them, but Eckerson attributed the effect of these acids to the hypocotyl portion of the seedling. The increased absorption and germination noticed by Davis (1917), Shull (1920), Harrington (1921), and Evans (1922), under high temperatures during germination are due to both the breaking up of the colloids and rapid diffusion of gases.

A number of varieties have been noted to possess dormant or weak embryos. Dormant embryo improves after storage, but weak embryo which generally results from the wide crosses, germinates readily. Dry heating as a method to hasten after-ripening has been widely used with varying results. Dixon (1902), and Harrington and Crocker (1918), noticed that the time needed for germination increased with exposure to high temperatures, and the latter hence concluded that Ewart's hypothesis about the protoplasm of the embryo, could not be a correct view. Groves (1917), and Jones and Tincker (1926), observed a gradual decrease in the percentage of germination with increased time of heating. David and Rose (1912), and Eckerson (1913), have shown that the changes in the after-ripening consisted in increased water holding capacity, increased activity of the catalase and oxidase. Harlan and Pope (1925) on barley, and Lyons (1928) on wheat, observed lack of embryo development in a small percentage of seeds although the endosperm was normal.

A big embryo implies a big reserve for the growing seedling, and this is possessed generally by big and heavy seeds. Blackman (1919), and Ashby (1930), showed the advantages possessed by a larger seedling over a smaller one, since the growth might be viewed as an exponential function of increments. A correlation between the heavy seed and the subsequent growth has been established by Ewing (1910), Rudolphs (1923), and Williams (1927). Harris (1912), demonstrated the existence of selective mortality in beans, such that the light and very heavy seeds were weeded out leaving the mean of the viable seeds unchanged.

It may be seen from the review of literature given above that the modes of securing the dormancy in seeds, are not confined to the dull monotony of one single method. An enquiry into the factors that caused the delay in germination in our material was therefore taken up.

Material. The following five varieties covering the parents and the crosses formed the material for the various experiments.

1. Strain N 14 (*G. indicum*) hereafter referred to as variety I.
2. Strain 2113 (*G. herbaceum*) „ „ II.
3. Garo-hill cotton (*G. Cernuum*) „ „ III.
4. Isolated hybrid from *G. indicum* × *G. Cernuum* – (I × C 99) „ „ IV.
5. F_1 progeny (2113 × I × C 99) „ „ V.

Methods. A large number of workers on this problem have used the rate of water imbibition as an index of impermeability in seeds, and in the experiments described below, the same measure is adopted. Random samples of one hundred good seeds from each treatment was placed between moist blotting sheets in germination trays. Progressive weights were recorded every four hours till there was no further absorption or germination. The emergence of the radicle to a length of five millimetres was taken as full germination, and such seedlings were removed as they were recorded so that the water absorbed was really the water necessary for the germination of the remaining seeds. The percentage increase in weights on the initial dry weight of seeds, was calculated and compared.

The influence of the coat properties on the rates of absorption in untreated seeds, when definite portions of the seed-coat were exposed, and when treated in different ways, were found. Other experiments were conducted to find the relation between the delay in germination, and the defects in the seed coat and embryo, when the water was normally absorbed.

Rates of Water intake: The five varieties exhibited inherent differences in the rate and total absorption of water. The curves of absorption (*Plate I. Fig. 1*) fall into two groups, viz., (1) for varieties I and II, and (2) for varieties III, IV, and V. The former group showed a substantial increase at the end of four hours followed by a rapid rise, and reached the upper saturation point before fifty-two hours. In contrast to this, the other group started absorption late, progressed slow, and touched the point of full saturation at the end of seventy-two hours. This group, continued to absorb even after the close of germination, and later studies on the embryo showed that such continuous absorption may be due to the empty spaces in the seed between the partially filled embryo and the seed-coat. Poor and delayed germinations resulted from the low rates of intake.

The differential permeabilities of the seed coats of different varieties, were found by blocking the micropyle with melted paraffin. Varieties IV and V (Plate I fig. I), showed the same rates of absorption as untreated seeds, while a perceptible fall was noticed in the other three varieties. The possible interference by the varying density of fuzz on seed was eliminated by treating the seeds with concentrated sulphuric acid. The behaviour of such treated seeds in the delayed lots, with or without closing the micropyle was in entire agreement with the other results. This experiment showed that in varieties IV and V, the micropyle did not function as a channel of water intake, and that the whole absorption was limited to the seed coat alone.

The rates of absorption through the micropyle, and the chalazal end, were determined. For this purpose the seeds were suspended on paraffin-coated paper floats, well cemented with a mixture of paraffin and wax, and the ends were just immersed in water, leaving the other portions of the seed free and dry on the float. Empty floats were used as controls, to find their absorption, and later correction. The results given (plate I fig. I), are very interesting and demonstrate the long initial delay in absorbing, low rise, and low total absorption particularly in varieties IV and V. The two varieties I and II, take in water readily both through micropyle and chalazal end.

This set of experiments prove that the varieties exhibit different absorption rates, and that the delay is partly due to the closed micropyle and low permeability of the seed coat.

Chemical properties of the seed coat. Hand sections of the seed coat were examined. and micro-chemical tests were tried with a view to find the chemical nature of the seed coats in these varieties. The presence of cutin was negatived by the action of Sudan III, and alcoholic solution of chlorophyll. There was no tannin or pectic compounds. Dilute acids and bases showed a tendency to break apart the seed coat at the junction of the palisade and the inner epidermis, more readily in the permeable group. This might be due to the looser arrangement of the cells or to the presence of less binding material. Cuprammonia dissolved very quickly the unthickened portion of the palisade in varieties I and II, and the quickness with which the walls went into solution, could be seen from the number of brown masses shooting out of the palisade. The 'light zone' of the palisade often referred to by other writers was very prominent in the hard seeds due mostly to the greater thickening and deposit of lignin. The lumen of the palisade in the permeable and impermeable groups was completely disorganised by concentrated sulphuric acid in about three and eight hours respectively. The brown pigment layer probably resisted the acid action in the latter.

Hard seeds were not different with regard to their moisture content from other seeds, but their ash contents (Table IV) were low, probably due to the greater amount of organic colloids.

Mechanical restraint imposed by the coat. It is commonly known that the seed coat is weakest at its full water holding capacity. The rates of absorption (Table I) for the seed coats only when the contents are removed, show that in addition to the low rate of water intake, there is higher saturation point for the impermeable varieties. The emergence of the radicle in such delayed varieties, does not synchronise with the rupture of the coat, showing that the pressure of the embryo is not sufficient to break through the seed coat. An attempt was made to follow the changes in the strength of the coat at different water contents, but the experimental error was very high that the differences were unreliable.

The toughness or hardness of dry coats was also measured with the apparatus designed by Puri and Venkataraman. Weights were slowly added till a puncture in the seed coat was made by the pin resting on it. The average pressure required to puncture through the seed coat at the mid point on the dorsal side of one hundred seeds of each variety was found. Impermeable varieties have a higher scale of hardness.

It was found that the thickness of the seed coat measured on median cross sections (Table IV) followed closely the gradation of permeability and hardness.

Hardness is also conditioned by the presence of certain substances like cutin, lignin, etc., which lower the elasticity of the structure. The elasticity or the precentage stretching power of the coat was determined, by finding the percentage increase in the dimensions of the soaked seed, after fixed intervals of one and two days. The maximum distension (Table IV) is obtained with varieties I and II, at the end of a day, and moderately high increase with the other two during the same interval. The low elasticity of the coat will resist the swelling by imbibitional and osmotic forces of the normal embryo. The necessary pressure for breaking the coat fails to develop, and leads to delay in germination.

Methods of overcoming the seed coat defects. Partial removal of the seed coat, reduction of the seed coat thickness, and modifying its colloidal nature, were tried.

The embryo was made to absorb water directly by removal of the seed coat at the butt end of the seed. The rates of absorption are very high (Plate I. fig 1) in all the varieties, as the limiting agency of the seed coat has been removed. The embryo greedily absorbed water and swelled rapidly. The radicle in hard varieties emerged through the cut end taking a curved path; while they emerged through the micropyle in other varieties.

Strong commercial sulphuric acid was allowed to act upon the seed for intervals of 15, 30, 60, 90, 120, 150, minutes. The rates of water intake (Plate II. fig 1) show a steady and progressive increase in varieties IV, and V till 150′ treatment, whereas this increase in varieties I and II, is absent beyond 15′ treatment. Treatment up to 15′ only removed the fuzz adhering to the seed coat. The slow action of the sulphuric acid on hard seed coats seems to be due to a difference in its composition. The increased rate and total germination (Table I) obtained, for varieties III, IV, and V, in the two experiments indicate the bad effects of such hard seed coats in untreated seeds.

Constant temperatures of 28, 35. 40, and 45, degrees centigrade were maintained with an incubator. The rate of absorption increased with rise in temperature (Plate I. fig 2), in all the varieties, and the germination (Table III) also increased in varieties IV, and V, up to 40 degrees. Though there appears to be definite lethal temperatures for the different varieties, hard types possess a higher optimum for germination. The radicle was injured at 35 degrees in varieties I to III, and it was seen just as a white speck lacking growth.

Characters of the embryo. The size and weight of the embryo influence the germination. It was suspected that poor embryo development might be responsible for part of the poor and delayed germination in the varieties, and to test this possiblity, the proportional weights of the embryo and the seed coat for the different varieties (Table V), and for the different seed weight groups (Table VI), for variety V, were determined. It may be seen that the delayed varieties have a lower proportion of the embryo to the seed coat, than varieties I and II. The variability of the embryo in hard seeds is nearly double that of the permeable group, while the variability of the seed coat is practically unaffected. The proportion of the embryo to the seed coat in different seed weight groups shows that 3·2 % of the normal looking seeds lack embryo, and nearly 34 % possess embryos arrested at varying stages of development. The disparity in the proportional weights of the embryo and the seed coat, is gradually lessened from the lighter seeds to medium heavy seeds. Owing to the difference in their structure and composition, an equal rise in the weight of the seed coat and the embryo will not proportionately increase the breaking strength of the former and the swelling pressure of the latter. Each small addition to the coat will increase its chances for delay in germination.

In order to test this hypothesis 2000 single healthy seeds from variety V were weighed and grouped according to seed weights. These were sown in small bed and kept watered through out the experiment. The record of germination was maintained up to twentieth day after sowing, and as soon as the seedling emerged, it was classified as normal or shrunken. The proportion of normal seedlings in relation to the total germination (Plate II. fig 2) from each of the seed weight groups, show a rise till 85 mgs., and a fall to zero later. An average difference to four days in the time taken to germinate was obtained between the normal and shrunken seedlings, and this difference would be very much increased under rapidly drying field conditions. The form and nature of the curve obtained for the germination add weight to the previous hypothesis that the delay and failures in light seeds are due to poor embryo, and that in heavy seeds, due to thick and unyielding seed coats. The maximum germination composed of good seedlings is obtained from average seed weights, due to the balanced development of the seed coat and the embryo. The embryo in light seeds was very variable, but in medium seeds and heavy seeds, the variability was very low.

Another cause for the delay may be the dormancy of the embryo, which sometimes requires after ripening. Dry heating the seeds brings about this change earlier. Short exposures of one and three hours at 50 degrees centigrade, and a long exposure of forty eight hours at 40 degrees were given. The results obtained were not consistent, and generally the rates of absorption were either decreased or remained unaffected. A slight forcing effect at long exposures (Table III) was noticed in varieties I and II, while varieties IV and V, exhibited a reduction in total germination.

Discussion. The factors causing delay in germination in the material under study, have been traced to both seed coat and embryo. The environmental and developmental causes leading to the presence of such hard seeds have been noted to be (1) an unusally dry period during the phase of crop maturation, and (2) the extra vigour of the plant in the early stages of its growth. As all the varieties were raised during the same season, the climate does not seem to be the casual factor. It was shown that the F-1 plants were vigorous, and it is very likely that these fast growing vigorous plants utilised the moisture available in the soil very rapidly and met with a scarcity at the fruiting period in the same manner as found by Jones in vetch. In addition, the early and quick development of thick seed coats in such types, may have adversely affected the development of the embryo.

The wide range of variability of the embryo weights in I × C 99, (although in its nineth generation), is probably due to the union of dissimilar gametes, because the two parents of this cross do not show such high variabilities. The percentage of empty seeds is very much higher than the figure obtained by Lyons for wheat. Failures in hybrid are maximum in light and very heavy seeds, and this result is similar to that found by Harris in phaseolus, but the causes of such failures appear to be different, viz; (1) due to the poor embryo in light seeds, and (2) due to thick impermeable seed coats in heavy seeds resisting the force of the expanding contents. The lower rate of absorption is partly due to the restricted transmission by the hard seed coat, and partly the result of slow absorption by the poor embryo through the two points of contact with the seed coat at the micropylar and chalazal ends. The embryo, however small or weak, readily absorbed and germinated when the seed coat was opened, showing that it was not dormant.

The differences in the rate and total quantity of water absorbed by the varieties, are due to the differences in the composition of the seed coat, and the environmental adaptations. A rapid absorption and a lower demand for water in *G. indicum* and *G. herbaceum*, are indispensable for their continuous survival, because they are generally found in dry places with rainfall not exceeding 30 inches, most of which are received in small quantities. The higher minimum water needed for germination by *G. Cernuum*, and its crosses are perhaps adaptations to the heavy downpours received during the year, in their native habitat (Assam). Part of the higher requirements in the hard seeds, may also be due to empty spaces between the weak embryo and the seed coat which gradually get filled up with water, or due to the colloidal composition of such coats.

The delay in the permeable seeds is due to the high breaking strength of the seed coat. The observations in the laboratory where the radicle emerged through the cut butt ends, and the germination of late seedlings in the field with the unbroken seed coats, are due to the failure of the embryo to develop the requisite pressure.

The various causes indicated, and the various methods tried in this paper to quicken and improve the total germination, show that the varieties possessing good embryo with hard seed coats, could be modified to produce a more vigourous and better crop. On the other hand, those containing weak embryos could only be induced to germinate without very much adding to the yield.

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Summary. (1) Delayed germination was observed in an interspecific cross in cotton. (2) The rate of water absorption was associated with the rate and total germination. The parents were differently permeable to water and this was inherited by the hybrid. (3) The minimum quantity of water required for hard seeds was very high in comparison to others. Hard seeds limited or excluded water on account of closed micropyle, or the reduced size of the lumen in the palisade cells. (5) The breaking strength of the coats was high

and the embryo was generally unable to develop this pressure by swelling. (6) Reduction of seed coat thickness by carbonisation, or removal of a portion of the seed coat, increased the germination. (7) Better germinations at higher temperatures were obtained with hard seeds. (8) The composition of the seedcoat is probably colloidal in nature, and this is shown by the low stretching power, high breaking strength and low ash contents. (9) The apparent vigour of the first generation hybrid resulted in the production of hard and thick seed coats. (10) The embryo development in the hybrid was very variable, and about 4% lacked embryos. (11) The proportion of healthy seedlings was most in medium heavy seeds, and the total germination was equally high here (12) Weeding out of heavy and light seeds was likely under normal conditions due to the defects in the seed coat and the embryo. (13) The embryo in hard seeds was only partially developed and occupied only a portion of the seed cavity. The seed coat transmitted water in hard seeds with poor embryo, through the two points of contact only, resulting in slow germination. (14) The embryo was not dormant but was only weak. Dry heating protracted the germination or had no effect.

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Table I.

Percentage Germination.

No. of hours.	Untreated at 28 C.					Open at chalayal end.					Untreated and micropyle closed.					Delinted and micropyle closed.					Seed-Coat alone ** (Embryo removed).				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
24	...	...	...	...	...	...	...	...	...	...	12	10	...	..	...	12	10	...	...	...	79	49	50	48	41
28	...	...	...	...	...	28	31	7	5	4	32	34	...	...	...	32	34	...	...	...	88	54	60	53	47
32	50	...	...	...	...	57	51	16	16	14	58	62	9	10	20	58	62	9	10	20	90	56	71	63	49
36	55	...	...	...	...	84	95	23	23	23	72	86	23	20	32	72	86	23	20	32	...	64	79	70	55
40	83	...	...	...	...	91	97	57	42	51	80	88	41	25	39	80	88	41	25	39	...	66	84	75	60
44	88	3	2	...	6	...	...	65	69	63	85	90	51	34	46	85	90	51	34	46	...	68	92	79	66
48	94	48	5	6	12	...	...	82	75	75	87	94	62	44	48	87	94	62	44	48	...	...	97	81	73
52	...	89	17	16	16	...	...	84	83	81	87	94	72	52	59	...	...	72	52	59	...	...	106	85	76
56	...	90	31	24	26	...	...	86	85	88	87	94	76	52	59	...	...	76	52	59	...	...	108	90	83
60	...	95	39	26	38	...	...	86	85	89	87	94	78	52	62	...	...	78	52	62	...	...	...	94	87
64	...	...	57	34	40	...	...	87	85	91	87	...	78	56	64	...	...	...	56	64	...	...	...	99	91
68	...	...	75	36	40	...	...	87	85	91	...	...	78	58	64	...	...	...	58	64	...	...	...	101	99
72	...	...	75	36	40	...	...	87	85	93	...	...	78	58	64	...	...	...	58	...	...	...	...	108	103
76	...	...	80	38	44	...	...	88	85	93	...	...	78	60	64	...	...	...	60	...	...	...	...	112	109
80	...	...	...	38	48	...	..	...	...	...	...	...	...	60	64	...	...	...	...	...	...	...	...	114	115
84	...	...	...	40	58	...	...	...	...	...	...	...	...	60	64	...	...	...	...	...	...	...	...	...	...
88	...	...	...	40	...	...	...	...	...	...	...	...	...	60	...	...	...	...	...	...	...	...	...	...	...
92	...	...	...	44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
96	...	...	...	46	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

* Percentage moisture absorbed.

Table II.

Percentage Germination.

No. of hours.	Delinted with H_2SO_4 15 mts.					Delinted with H_2SO_4 30 mts.					Delinted with H_2SO_4 60 mts.					Delinted with H_2SO_4 90 mts.					Delinted with H_2SO_4 120 mts.					Delinted with H_2SO_4 150 mts.				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
16	4	4	...	...	...	4	8	...	...	...	6	2	...	...	...	4	4	...	...	...	4	8	...	...	...	4	4	...	...	...
20	10	14	...	...	...	10	18	...	...	...	10	14	2	...	...	12	8	10	2	...	10	60	12	4	4	16	12	14	6	4
24	28	66	12	...	4	30	74	16	4	6	42	60	24	6	10	52	54	24	8	10	38	68	26	32	30	36	32	54	10	38
28	32	74	22	2	20	40	80	30	16	20	60	74	36	30	22	60	62	52	36	44	64	76	46	62	64	60	70	76	34	60
32	58	82	50	12	28	74	86	54	38	28	72	76	56	56	44	78	78	60	64	54	72	82	62	70	86	76	76	86	38	82
36	72	88	52	30	44	84	92	56	44	44	88	78	68	76	48	82	84	64	76	62	82	88	70	74	88	80	88	90	72	84
40	84	...	56	30	46	...	96	62	46	48	...	80	74	78	62	...	...	72	82	68	...	...	74	78	90	...	...	90	80	92
44	...	...	60	30	50	...	...	70	48	60	...	...	80	78	70	...	...	76	86	72	...	...	84	86	90	...	...	...	90	96
48	...	...	66	34	52	...	...	76	54	62	...	...	84	78	76	...	...	80	...	74	...	...	...	...	90	...	...	...	90	96
52	...	...	78	42	58	...	...	84	58	66	...	...	...	80	...	...	...	...	...	76	...	...	...	...	...	...	...	...	...	...
56	...	...	...	46	60	...	...	...	60	68	...	...	...	...	...	...	...	...	...	82	...	...	...	...	...	...	...	...	...	...
60	...	...	...	52	62	...	...	...	62	70																				
64	...	...	...	54	68	..	...	...	68	72																				
68	...	...	...	56	70	...	...	...	70	78																				
72	...	...	...	56	72	...	...	...	...	78																				
76	...	...	...	...	72	...	...	...	...	...																				
80																														
84																														
88																														
92																														
96																														

Table III.

Percentage Germination.

No. of hours.	Maintained at 35°C.					Maintained at 40°C					Maintained at 45°C.					Maintained at 50°C.					Dry heated for 1 hour at 50°C.					Dry heated for 3 hours at 50°C.					Dry heated for 48 hours at 40°C.				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
20	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
28	29	...	...	...	...	28	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
32	73	8	...	5	...	59	...	...	10	...	2	1	...	1	...	...	...	...	...	...	6	...	...	...	...	4	...	...	...	...	14	2	...	2	...
36	84	27	6	15	2	65	3	...	40	1	26	3	..	6	...	...	...	...	...	...	14	...	...	...	...	16	...	...	2	...	44	8	...	2	...
40	92	70	15	30	14	69	60	2	55	1	31	12	...	15	...	...	...	...	...	...	56	...	...	4	...	60	...	...	6	...	62	28	...	14	...
44	...	87	42	42	26	71	81	12	74	2	36	41	1	29	...	...	...	...	1	...	78	6	2	16	...	78	6	...	12	...	64	40	4	14	...
48	...	94	63	43	48	73	93	30	84	7	41	64	2	43	...	...	...	...	2	...	80	34	4	26	...	84	34	4	20	2	68	50	12	24	2
52	...	95	64	45	57	75	94	50	85	19	45	81	12	69	1	...	...	...	2	...	82	82	20	34	2	...	82	12	40	4	70	70	40	30	6
56	...	...	70	46	61	...	...	55	85	38	...	82	24	70	3	...	...	...	3	6	...	86	46	42	12	...	86	40	44	22	70	90	62	32	8
60	...	...	73	46	64	...	...	58	86	64	...	...	28	74	3	...	...	...	...	6	...	...	60	50	18	...	..	54	50	24	70	92	68	...	16
64	...	...	75	47	64	...	...	63	...	81	...	...	29	78	16	...	...	...	...	...	...	...	72	58	42	...	...	60	54	42	...	...	74	...	32
68	...	...	...	...	64	...	...	65	...	90	...	...	33	...	20	...	...	...	...	...	...	...	76	...	48	...	...	...	56	48	...	...	76	...	46
72	...	...	...	...	64	...	...	...	...	91	...	...	...	...	36	...	...	...	...	...	...	...	82	...	66	...	...	...	...	56	...	...	78	...	46
76	...	...	...	...	...	...	...	...	...	...	...	...	...	...	59	...	...	...	...	...	...	...	...	...	76	...	...	...	...	58	...	...	...	...	46
80	...	...	...	...	...	...	...	...	...	...	...	...	...	...	66	...	...	...	...	...	...	...	...	...	78	...	...	...	...	60	...	...	...	...	46
84	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	80	...	...	...	...	62	...	...	...	...	...
88	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	84	...	...	...	...	...	...	...	...	...	...

Table IV.

Selection No.	No. of determinations.	Average force required to puncture the seed cast in lbs.	Standard deviation.	Percentage increase in				Thickness of seed coat in μ	Percentage	
				Length		Breadth			Moisture	Ash
				1 day	2 days	1 day	2 days			
N. 14. I.	100	7·10	0·80	22·5	23·0	20·5	22·0	276	9 14	3·22
2113 II.	100	6·45	0·81	21·5	22·0	18·0	18·5	304	8·87	3·10
G. Cernuum III.	100	8 90	1·38	14·0	17·5	15·5	17·0	312	8·86	2·60
I × C99 IV.	100	8·75	1·08	9·5	15·5	8·5	14·0	328	8·90	2·49
(I × C99) × 2113 F_1 V.	100	10·80	1·25	5·5	7·0	5·0	8·5	358	8·11	2·57

Table V.

Selection No.		Percentage Weight.		Co-efficient of variability.	
		Seed-Coat	Embryo	Seed-Coat	Embryo
N. 14.	I.	48	52	12	11
2113	II.	50	50	11	11
G. Cernuum	III.	55	45	15	17
I × C 99	IV.	60	40	13	31
(I × C 99) × 2113 F	V.	57	43	19	32

Table VI.

Seed weight in m. gms. per seed. (Variety V)	Seed coat weight in m. gms. per seed.	Embryo weight in m. gms. per seed.	Percentage weight of embryo.
35	31	4	11
45	38	7	16
55	43	12	22
65	38	27	41
75	41	34	46
85	47	38	45
95	52	43	46
105	57	48	46
115	64	51	44
125	69	56	45
135	80	55	41

Plate I. Fig. 1.

Rate of water intake.

Role of Seed-Coat and Micropyle.

1.———untreated (Control).
2.- - - - - „ Micropyle blocked.
3.—.—.—.—Delinted with Conc. H_2So_4.
4.—.—.—. „ „ „ Micropyle blocked
5—×—×—Untreated Restricted absorption through Micropyle.
6..—..—.. „ „ Chalazal end.
7.............. „ „ Chalaza exposed.

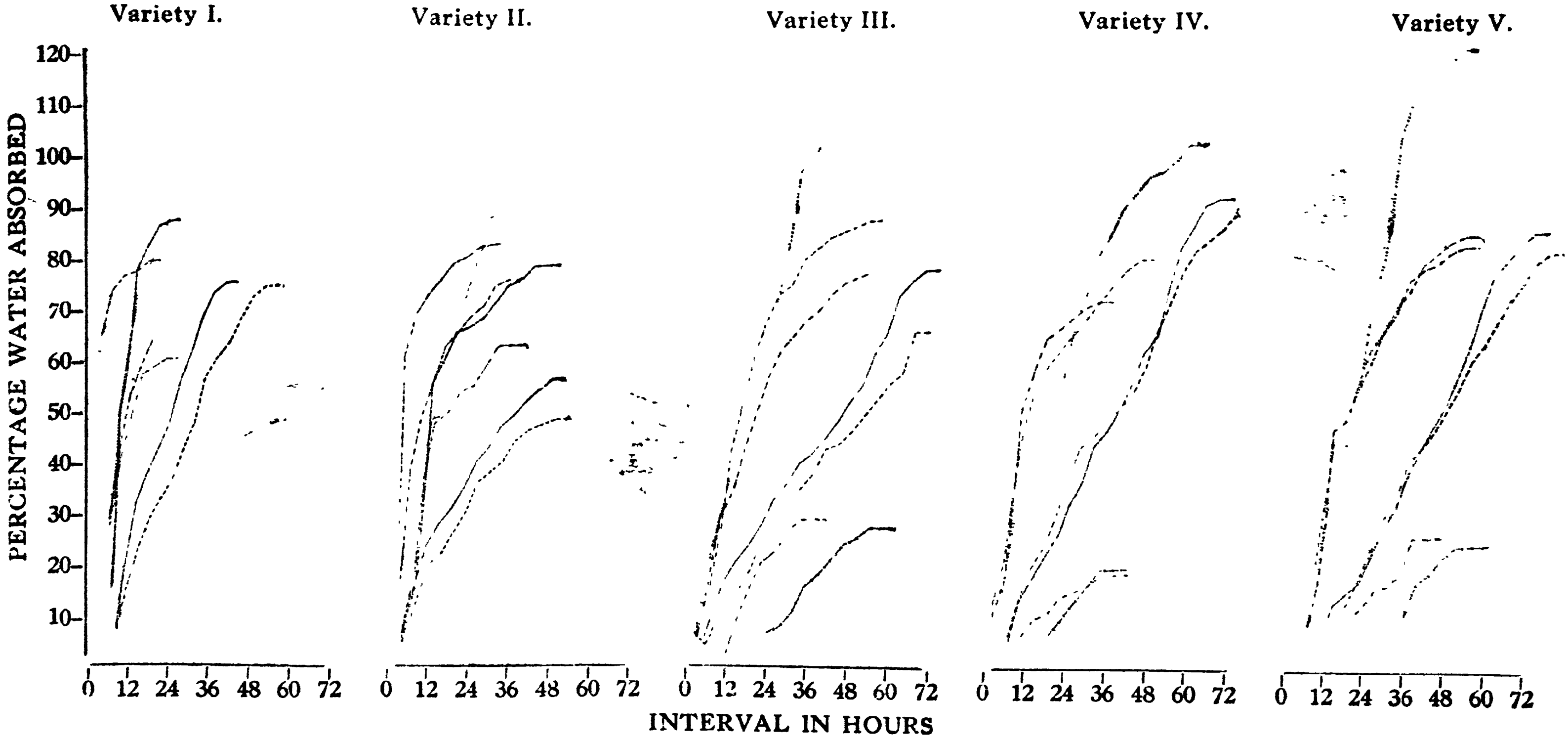
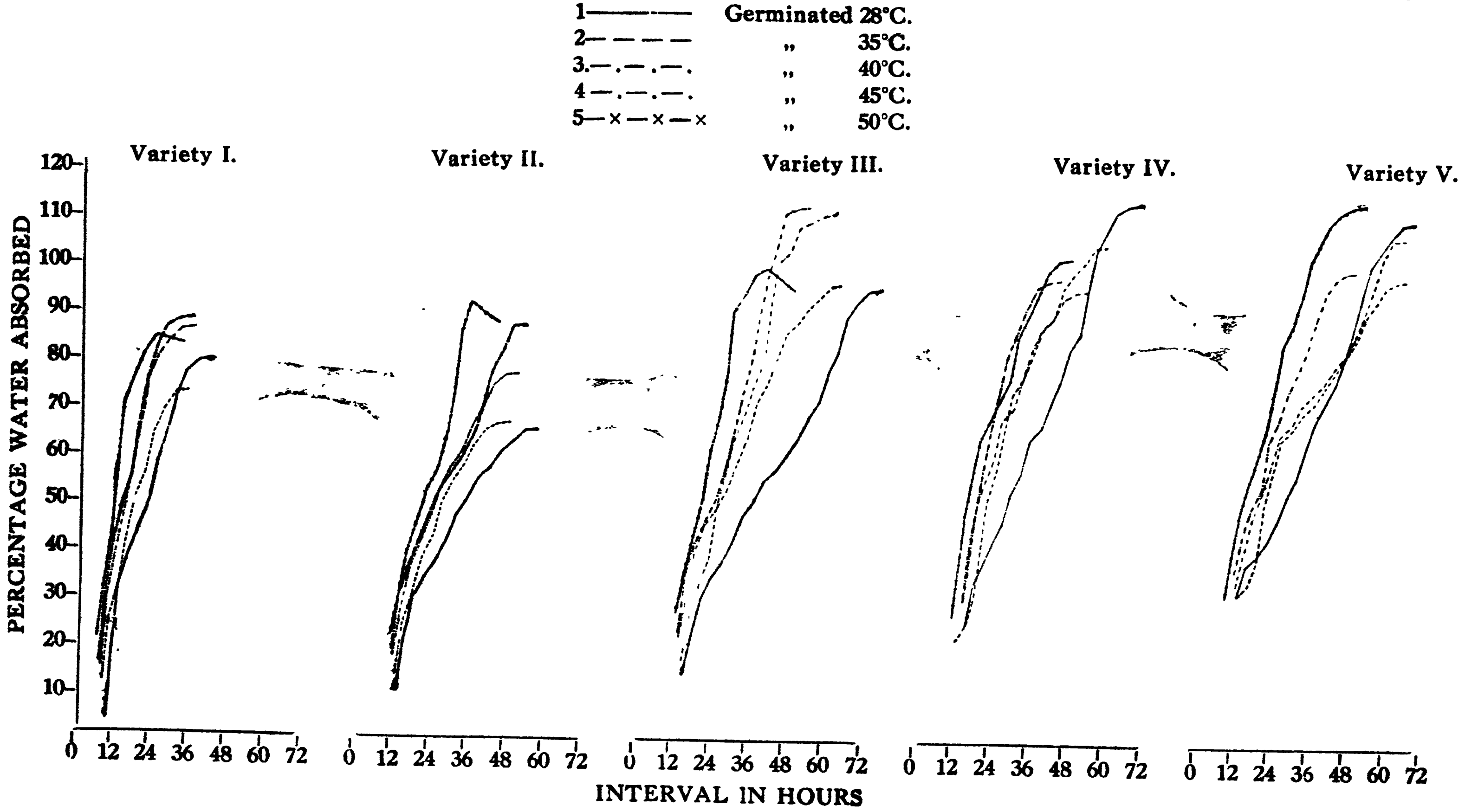


Plate I. Fig. 2.

Rate of water intake.

Effect of temperature.



Rate of water intake.

Effect of concentrated $H_2 So_4$ on Seed Coat.

Plate II. Fig. 1.

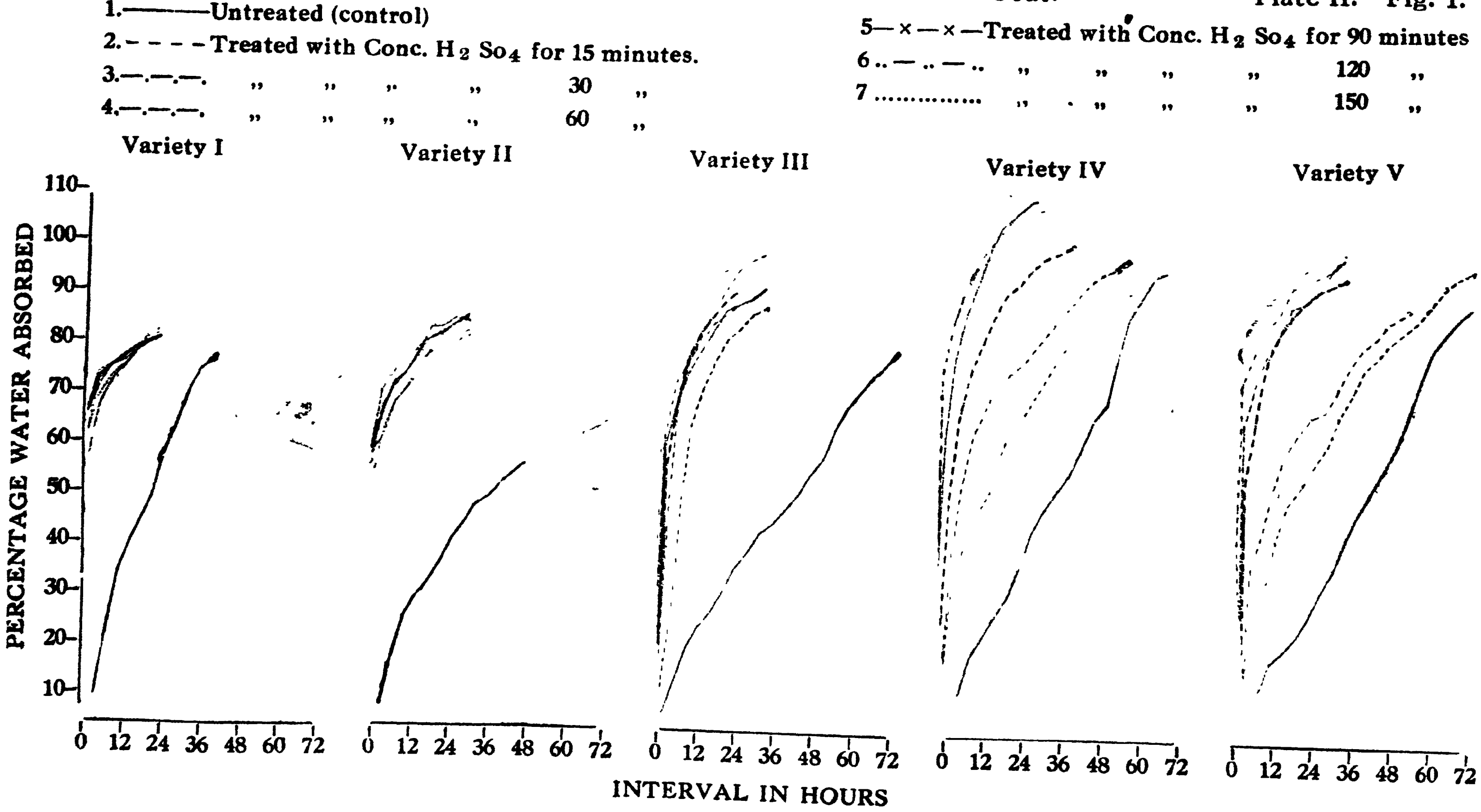
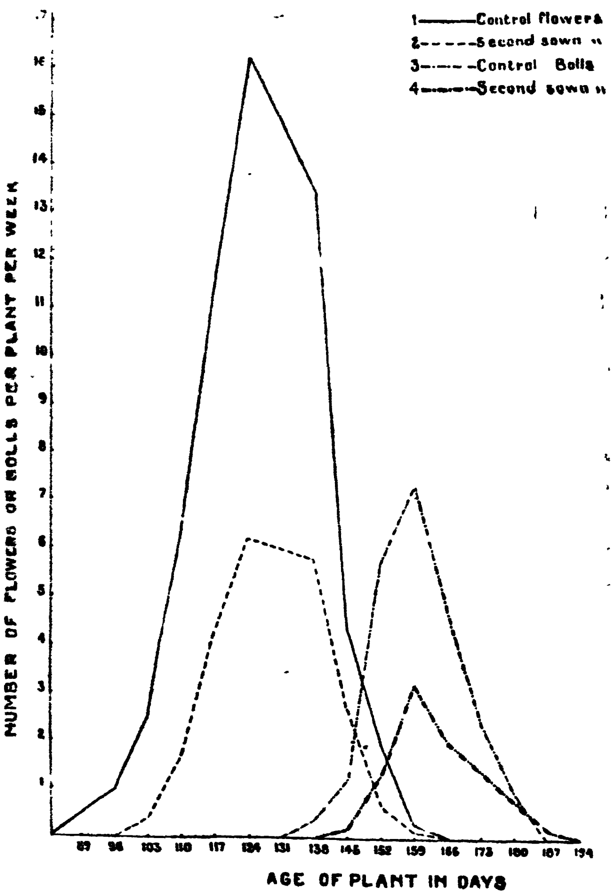
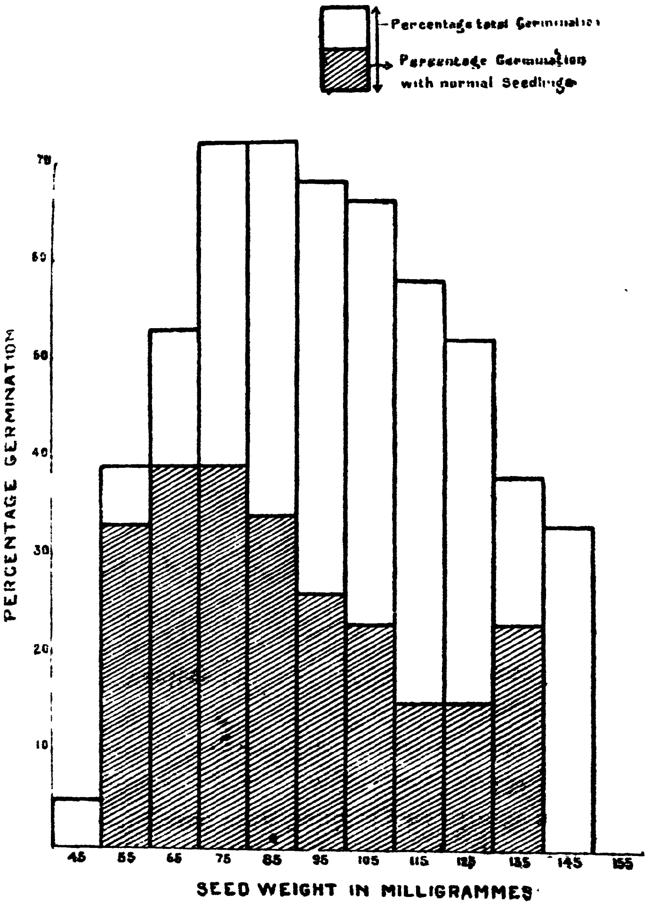


Plate II. Fig. 2.



FLOWER & BOLL PRODUCTION



SEED WEIGHT & GERMINATION

A STUDY OF THE ROOT SYSTEMS OF THE COMMON GRASSES AT THE LIVESTOCK RESEARCH STATION, HOSUR

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Under tropical conditions the deciding factor for pasture is the moisture in the soil. In the localities where drought is regular, grasses that are adapted to resist longest will be the best suited for the locality. The grasses have mechanism for regulating evaporation of water from the lamina, and means to explore, in search of moisture and nutrition from the soil. It is with the object of knowing more about this aspect of the grass problems, that this study was taken up. The plants were individually very carefully dug up, their roots washed with water, air dried, and a number of measurements of roots taken. The results obtained are given in the table below :—

Name of grass	No. of plants studied.	Average length of roots	Depth to which they are seen penetrated	Area of the distribution of the roots	Nature of the adventitious roots	Remarks.
Andropogon contortus	42	1'8"	1'6"	1'9" x 1'9"	Thin, hairy & dense	Roots have lateral growth
Andropogon pertusus	27	2'6"	2'3"	15" x 15"	do	Runs vertically down
Cynodon dactylon	20	Indefinite traced to 3 feet	Indefinite traced to 3 feet	Very wide spreading	Thin, very sparsely distributed Rhizomes more prominant	
Digitaria sanguinale	16	1'3"	1'2"	15" x 12"	Thin, hairy & medium bushiness	
Pennisetum cenchroides	24	1'7"	1'3"	12" x 12" in one case even up to 18" x 16"	Thick roots, very sparse going vertically down into the soil	
Eragrostis sp.	18	9.5"	8"	10" x 10"	Thin. & of medium bushiness	
Panicum sp.	18	8"	7"	10" x 10"	do	

From the above results, it will be seen that there are notable differences in the root systems of the various grasses studied. It is interesting to note that in some cases, the length of roots and the depth to which they penetrate are nearly equal. In others, the length is very great while the depth to which they penetrate is very shallow. It has not yet been possible to correlate the length of the root system with the type of soils, dry or wetland. It would however appear that grasses found in wetland have thin roots penetrating shallow. *Cynodon dactylon* on account of the indefinite length of roots and the indefinite depth to which they penetrate seems to resist not only drought but continue to grow despite the scraping of the ground or shieling method adopted by the grass cutters. On one occasion, the author noticed a root penetrating to a depth of well over 4 feet of sub soil which was quite hard and dry.

Andropogon contortus is drought resisting to a remarkable degree. It does not seem to depend mainly on the depth to which the roots penetrate. The habit of growth is spreading and prostrate, excepting during the growing season, and it is able to control evaporation better than *Cynodon dactylon.* During the dry period it is often noticed that the cattle prefer the *Andropogon contortus* which is apparently dry to *Cynodon dactylon* which seemed more papery than leafy. It would be interesting to continue and extend the study to other grasses.

Note :— Farm Manager, Mr. A. H. Subramania Sarma, was in charge of this work. This note is adapted from the paper on " the Study of Pastures at Hosur " read by the author at the Indian Science Congress, 1932.

INTENSIVE MANURING OF PASTURES UNDER LOCAL CONDITIONS

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The object of this experiment was to force the growth of grasses under permanent pasture during the rainy season and thus increase the stocking capacity of the pasture; a pasture consisting of *Andropogon contortus. Andropogon pertusus, Digitaria sanguinale var. ciliaris* and *extensum* and *Indigoferas* was selected for the experiment. This had received 3 cwts. of lime in 1927 and 20 cartloads of Farm Yard Manure, 3 cwts. of Bonemeal, and 1 cwt. of Super phosphate in 1928. The experiment commenced in September 1929. Four ½ acre plots (A, B, C and D) in one square block, were fenced off for the manuring experiment. and pasture all round the experimental block was used as control. The plots were fenced so that animals could graze in rotation i. e. first A, second B, then C and lastly D, back to A and so on. The rains began on 14th September and the rainfall for the month was 7·01 inches. There were about 11 rainy days during the month.

Eighteen Bull calves were chosen for the experiment; 9 as experimentals and 9 as controls. In each lot there were three of *Kangayams*, 3 of *Scindhes* and 3 of *Ongoles*. The grazing was done by tethering the animals.

The experiment started on 21—10—1929. The controls grazed outside the block and the experimentals in plot A. In addition to grazing, the animals received soiled guineagrass *ad lib*. Weights of each animal were taken twice a week.

Plot A was grazed off by the 17th November, when the animals were changed to plot C. In the meantime plot D was sown and 960 lb. hay collected, and it received 56 lb. of sulphate of ammonia on the 25th November, so that the herbage could grow in time for the animals to be put on it.

Later, the animals were changed to plot D. As there was no rain the herbage in plot D did not grow and that plot and plot C became dry.

The experiment was completed on 5th December 1929. The weights of the animals are given below :—

A. Experimentals.

Calf No.	Breed.	Date of birth.	Weight on 21—10—29 lb.	Weight on 21—11—29 lb.	Weight on 5—12—29 lb.	Difference in weight up to	
						21—11—29 lb.	5—12—29 lb.
59	Kangayam	17—11—27	564	574	598	+10	+34
52	do	25 —2—28	512	532	574	+20	+62
63	do	16— 7—28	462	431	486	-31	+24
11	Scindhe	—11—27	512	497	560	-15	+48
13	do	—12—27	546	554	578	+8	+32
20	do	12— 8—28	440	432	454	-8	+ 8
51	Ongole	27— 9—28	490	469	504	-21	+18
50	do	25— 8—28	525	502	497	-23	-25
127	do	24—10—28	469	442	500	-27	+31
			4520	4433	4751	-87	232

B. Controls.

Calf No.	Breed.	Date of birth.	Weight on 21—10—29 lb.	Weight on 21—11—29 lb.	Weight on 5—12—29 lb.	Difference in weight up to	
						21—11—29 lb.	5—12—29 lb.
58	Kangayam.	7— 5—28	532	514	541	- 18	+ 9
61	do	2— 7—28	455	430	483	- 25	+28
53	do	28— 2—28	532	497	469	—35	—63
9	Scindhe.	— 11—27	588	554	602	—34	+14
10	do	— 11+27	638	630	655	— 8	+17
16	do	1— 4+28	567	539	557	—35	—10
49	Ongole.	15— 8—28	574	543	595	—31	+21
48	do	5— 8+28	520	490	564	—30	+44
44	do	28— 3+28	602	550	609	—52	+ 2
			5008	4740		—268	+62

It will be noticed that all the controls lost weight, while among the experimentals only 3 animals have gained a little on 21st November, but by the end of the experiment when grazing was scarce all but one in the experimentals gained weight, and all but 2 in the controls also gained weight, but not to the same extent. From the experience and experiment conducted here it would appear that (1) Intensive system of manuring and grazing as in temporate regions is not suited especially for *Andropogon contortus* and (2) moisture in the soil is the deciding factor in the growth of grasses.

Note: Farm Managers, Messrs. H. Narahari Rao and A. H. Subramania Sarma were in charge of the experiment. This note is adapted from the paper on "The Study of Pastures and Meadows at Hosur" read by the author at the Indian Science Congress 1932.

Notes and Comments.

1. **The Agricultural College Day and Conference.** We take this opportunity to inform our numerous readers and well-wishers that it has been arranged to convene the twenty-second College Day and Conference during the last week of July commencing on the 28th of that month. In this connection we are glad to announce that Dewan Bahadur Sir T. Vijayaraghavachary Avl., the Vice President of the Imperial Council, Agricultural Research of Delhi, has very kindly consented to preside over the function. On behalf of the Madras Agricultural Students' Union,—under the auspices of which the annual

function is held—we hereby extend our invitations to all the members of the Union, our subscribers and the numerous well-wishers of the Union to render their cordial co-operation by attending the function, contributing papers of Agricultural interest to be read and discussed at the conference, and thus help to make the function a success. It is hoped that it will be advantageous both to the authors of the papers and the Conference committee, if contributors will kindly arrange to send in their papers and abstracts to the Union Secretary sufficiently early, for the preparation and issue of the Conference agenda in advance.

2. **The Agricultural Department and the Provincial Budget meeting.** It is gratifying to note that at the recent Budget meetings in the Legislative Council, the Agricultural Department and its work did not suffer any adverse criticism worth noting, though it has been the fashion with some public men to generalise and find fault with the department as a whole without taking any trouble to study the state of affairs, before rushing to such conclusions. On the other hand the demand for more demonstration and publicity, and for additional demonstration farms in the different agricultural tracts, really goes to show that the work of the department has impressed the agriculturists to a considerable extent. We would invite such of the public spirited men as really take interest in such matters and as entertain any doubts as to the usefulness of the Agricultural Department, just to visit the Institute at Coimbatore or some of the Agricultural Research Stations in the moffusil, study what is being done there, realise the scope and limitations of scientific work, and then give expression to whatever remarks they may be pleased to offer, instead of hastening to broad generalisations and undeserving remarks. The department always welcomes reasonable remarks and well-meant constructive criticisms.

3. **Election to the University Syndicate.** We offer our hearty congratulations to M. R. Ry., Rao Bahadur M. R. Ramaswami Sivan Avl., on his re-election to the Madras University Syndicate, for a further term of three years from this month. We need hardly add that it is likewise an honour to the Agricultural Department wherein the Rao Bahadur has laboured for several years. No one can deny that Mr. Sivan has done a great deal to point out to the educational authorities, the need for the encouragement of higher education in Agriculture. His re-election to the executive body of the University, is therefore a source of gratification to those interested in agricultural education. We wish Mr. Sivan all success in this further period, of strenuous and useful work in the Syndicate.

4. **Farewell to the Final Year Students.** The Union started a convention this year, when under its auspices, a public meeting was held to bid suitable farewell to the final year students of the College. Of late, the running of the Journal, punctually and of a standard worthy

of its past traditions, has so completely engaged the time and labours of the honorary workers in the Committee and the Editorial Board, that some of the objects with which the Union was started, in the earlier years, have been all thrown into the back ground. A ceremony like the one arranged by the Union would serve to impress on all old students, that, now that chances of employment in the Department are getting scarcer, the Union is the only link that keeps all 'Old Boys' in living touch with the *Alma mater.* It is proposed to keep at the Union a record of addresses of all old students and their activities and we would be thankful if all old students would correspond with us and keep us informed of their movements.

We wish the out going students a bright future in their careers.

The Pykara Scheme and Agriculture. We had occasion to publish in the November 1932 issue of our Journal, a short abstract of an able lecture delivered by the Government Agricultural Chemist, on "A case for the Electro-chemical Fixation of Atmospheric Nitrogen". The inauguration of the Pykara Hydro-Electro Scheme by His Excellency the Governor of Madras, during the month, has added considerably to the importance of the subject of that lecture. Hydro-electric power is used in other countries for the fixation of atmospheric nitrogen, and there is no reason why, state-controlled and suitably administered, it should not be used in our country, for a similar purpose especially as our soils are highly deficient in organic nitrogen, and as every attempt should be made to harness natural resources for augmenting the supply. Besides the possibility of manufacture of nitrogenous fertilisers, the new Hydro-electric Scheme opens out a vista of promise for giving a stimulus to several cottage industries that could be economically run on power. We fervently hope, that the Pykara Scheme will be utilised to its maximum advantage, by all land-holders, large and small, and that agriculture in South India, would by its utilisation, become a more paying proposition, than it now is.

ABSTRACTS

Variation in the Potein Intake of Sheep in relation to Wool Growth. A. H. H. Fraser and J. A. F. Roberts (*Jour. of Agricultural Science*, London. 1933, vol. 23, pp. 97—107). There has been a certain amount of interesting discussion recently, regarding the relation between protein intake and wool development in sheep, with special reference to the synthesis of cystine which forms an important part of the wool protein; and the present authors have examined the question of the effect of different levels of protein feeding on the quantity and quality of wool produced, using two lots of 20 sheep each, fed indoors on equi-calorific diets, one of which contained 52% more digestible protein (in the form of soyabean-meal) than the other. Comparison of samples of wool taken from the two lots at the beginning and end of the experiment, (148 days) and fibre measurements including fineness, length, and fibre-weight showed that there was no significant difference between the two groups in respect of any of the wool characteristics measured. In the case of the low protein group (given a basal ration containing a protein equivalent of 0·170 lbs.), it was found, that no less than 9·2% of the digestible protein fed, was recovered in the form of dry wool substance (46·1 lbs. of wool containing 6 lbs. of cystine corresponding to 1·19% of the weight of digestible protein fed). An increase of digestible protein above this limit made no difference to the rate of production of wool. The authors note that the optimnm protein intake for wool production, is almost the same as the optimum protein intake for increase of body weight in the growing animal. Comparing the cystine content of the proteins fed and the wool produced by the low protein group, the authors believe that synthesis of cystine occurred, and suggest that this synthesis may be a special function of the wool follicle, which is rich in cystine. (C. N.)

The Vitamin B. content of different samples of Indian rice by Spruyt's Colorimetric method. S. Gosh and A. Dutt. (*Indian Jour. Med. Res.* 1933, vol. 20, pp. 863—868). During the course of investigations on the beri-beri problem of Bengal, the authors had occasion to analyse about 50 samples of different varieties of rice collected in or near Calcutta and also obtained from Burma. A modification of Spruyt's colorimetric method was adopted for the estimation of vitamin B content, and some interesting results were obtained. A sample of "*deshi*" twice-boiled rice (middle grade) with the husk removed, consisted of about 15% red coloured and 85% brownish grains. The colour index (as showing the vitamin content) of the red grains collected separately was found to be practically the same as that of the whole sample, viz. 161. The same rice, when polished showed a colour index of only 122. A middle grade "*balam*" unpolished rice gave a colour index of 196 and the same rice when polished had a colour-index of 166. The outer colour of rice is not, therefore, an indication of its increased vitamin B content, and a good deal depends upon the degree of polishing. The average of 24 samples of "*atap*" rice is 110, and the average of 22 samples of parboiled rice is 133. The samples of "*dhenki-hulled*" rice examined were found to possess a lower colour-index than "*mill-hulled*" rice, which appears to be contrary to the prevalent view in India. The most important factor affecting the vitamin B content of rice appears to be the degree of polishing to which the grains have been subjected. (C. N.)

Use of irrigation water on Farm crops. A. E. Palmer. (*Bulletin No. 125, new series of the Canadian Department of Agriculture*). The paper reports the results of experiments with the irrigation of wheat, alfalfa, potatoes, sugar beets and sunflowers, covering a period of from two to six years, conducted on a medium sandy clay loam soil at the Dominion Experimental Station, Lethbridge, Canada. The influence of different number of irrigations and of irrigations at different stages of growth of the crops, has been examined. No consistent difference was noted either in the cooking quality of potatoes or in the sugar-content of the beets, receiving different irrigation treatments. The experiments indicated that, including the available water in the soil at the begining of the season, wheat requires from 1·50 to 1·75 acre-feet of water, alfalfa 1·75 to 2·25 acre-feet and potatoes about 1·50 acre-feet to produce good crops. Soil moisture determinations made of each foot-depth of soil, to a depth of six feet, before and after each irrigation, showed that a six inch application of water, failed to penetrate into the soil to a depth of six feet in more than half the plots, when the soil moisture content was below 11% at the time of irrigation. With the moisture content between 11% and 13%, 60 to 70% of the observations, showed, that the water had penetrated to six feet. The water applied to almost all of the plots having a soil moisture content above 13%, went down six feet and more. (C. N.)

Effect of reduced oxygen pressure on Rice germination. Jenkin W. Jones (*Jour. Amer. Soc. Agronomy*, 1933, vol. 25 No. 1, pp. 69—81). A large acreage of the rice land in California is so foul with barnyard grass (*Echinochloa crusgalli*) and varieties, that special irrigation methods have been developed to control these weeds. The method of irrigation generally adopted, is to sow the rice broad-cast in the seed-bed submerged under water; the land is continuously submerged after seeding to an average depth of about 6 inches, until the rice is mature enough to be drained for harvest. Under these conditions, seed rice germinates, but, seedlings of most forms of barnyard grass are unable to emerge through the 6 inches of water. The draw back of this system of cultivation is, that germination of rice is poorer, and heavier rates of seeding are required to obtain good stands, than under the usual system of alternate flooding and draining of the seed-bed, in the early stages till the seedlings have emerged. It was noted that drilling in the seed, in a dry seed-bed followed bv continuous submergence, produced very low germination, and the object of the present investigation was to examine the conditions influencing the rate of germination. The results were as follows:—(1) In the three years during which this work was conducted in the field, rice sown on the surface of the soil, and ½ inch and 1 inch deep, then continuously submerged, produced an average of 78·14, 20·00, and 2·66 % of seedlings respectively. No seedlings were obtained from seed sown 1½ or 2 or 2½ inches deep, and continuously submerged either in the field or in pots in the green house, except when oxygen was forced into the soil. (2) The results obtained from germination studies in pots into which oxygen was forced, indicate that a deficiency of oxygen is probably the principal factor causing a lack of normal germination in rice seed, sown at various depths and continuously submerged with water. The development of the radicle is initiated by a suitable supply of oxygen. (3) When continuously submerged, a ½ inch layer of clay adobe soil materially reduced the oxygen pressure and a layer 1 inch or more in depth reduced the oxygen pressure to a point at which normal germination did not occur. (4) The results indicate that surface seeding in the water is the best practice when rice is grown by continuous submergence. (C. N.)

The influence of raw milk on Teeth and Growth. E. Sprawson (*Scottish Jour. of Agri. 1933*, vol. 16 pp. 23—31) The author quotes numerous instances to show that the use of raw milk is conducive to perfection of dental development and structure, as well as of the body as a whole. and confers an immunity to dental caries, which is accentuated in these davs of high carbohydrate diet. Milk that has been pasteurised or sterilised, loses appreciably its dietetic value, in respect of the factors which bring about immunity and good health. The author shows how among the primitive races who suckled their young till past the time of eruption of the deciduous dentition, such as the Australian aborginals, African races, Eskimos and others, dental caries was unknown; and advocates, that raw milk should be continued upto not less than the age of 14 years. In connection with the supply of raw milk, care should be taken to obtain the milk only from tubercle-free animals (milk tested with the double intradermal test) so as to avoid infection with bovine tubercle. The milk of goats has much to recommend it, as goats are almost absolutely immune to tubercle. Goat's milk is relished by children and is particularly efficacious in providing immunity to dental caries.

(C. N.)

The Nature of Phosphate Fixation in Soils.—M. C. Ford (*Jour. Amer. Soc. Agronomy*, 1933, Vol. 25. No. 2). It is well-known that soluble phosphates (like super) when applied to the soil are fixed in more or less insoluble forms; this fixation or "reversion" is especially great in laterite soils, where a good propotion of the applied phosphate is converted into forms which are insoluble and unavailable for plant-growth. The author has examined the nature of the fixation of phosphates in the soil. using soils and certain minerals like *hematite* (Fe_2O_3), *goethite* or *limonite*, ($Fe_2O_3 . H_2O$), *bauxite* ($Al_2O_3 . x H_2O$), etc. which are believed to be influential in bringing about the reversion of phosphate. The soils fixed phosphorus in varying degrees in forms not easily soluble in sulphuric acid of pH 3·0. The phosphorus fixed by soils as calcium or magnesium phosphates, is readily soluble in weak solvents and thus quite available to plants; that which is fixed as ferric and aluminium phosphates by ferric and aluminium hydroxides, chlorides or sulphates, is at least in part easily hydrolysable and available to plants; while, that which is fixed by *goethite* (*limonite*) is very insoluble and only slowly available to plants; the phosphorus fixed by *bauxite* was of intermediate solubility. *Hematite* did not fix any phosphorus, and hence the dehydration of *goethite* (by heating) destroyed its phosphate fixing power. The partial dehydration of *bauxite* increased its fixing power. The phosphates formed with *goethite* and partially dehydrated *bauxite* were found on X-ray analysis to be crystalline; The great power for 'reversion' possessed by laterite soils is attributed to the presence of *goethite* (*limonite*), *bauxite* and similar minerals. Heating soils to 185°F, destroyed the "reversion" power or the power to fix in insoluble forms, probably due to dehydration of *goethite*. The amount of *goethite* present is believed to vary greatly in different soils, and to persist in soils when once formed, because of insufficient heat in soils to dehydrate it. (C. N.)

Correspondence.

I

Spike Disease in Sandal.

Mr. P. S. Jivanna Rao writes to us as follows:-

The issue for November 1932 of the M. A. J., contains a summary of a lecture on the above disease, by Mr. M. Sreenivasayya of Bangalore and of the concluding address by the chairman, Rao Bahadur K. R. Venkatarama Ayyar, in which the impression is created, that spike disease has been definitely proved as communicable and that a 'death blow' has been given to the physiological theory. As a reference has been made to me, by the chairman, as an exponent of the physiological theory, and that theory was apparently not explained in all its aspects, I crave space for giving a brief summary of the theory, based on exact studies and observations made by myself and by various officers from time to time, the correctness of which cannot be questioned, and at the same time to point out some difficulties in our accepting the infection theory.

I. THE PHYSIOLOGICAL THEORY

1 Sandal is an obligate parasite and the haustoria are the chief organs of absorption.

2. In diseased plants, the haustoria and root ends are dead and the shoots are alive till the last stages; i. e., the plant dies and dries from the root upwards.

3. Though sandal indiscriminately attacks all kinds of hosts viz., dicotyledons and monocotyledons; herbs, shrubs, and trees and even such unprofitable substances as pebbles, sticks etc., those which are physiologically unfit, later free themselves from the parasite, in evidence whereof are the numerous scars found on the host roots e. g. Lantana. The haustoria consequently die of water starvation.

4. The real trouble with sandal, therefore, is in the absorbing system of which the haustoria are the most essential parts, and the death of these is the

root cause of the trouble, which becomes acute when an undesirable host like Lantana, dominates to the exclusion of other species

5. The exact manner of spike formation is as follows:- The death of the haustoria leads to shortage of water and its ultimate stoppage; the carbohydrate material formed in photosynthesis accumulates as starch, instead of being translocated as sugar, as this is a function of the transpiration current which is extremely slow; the leaf cells gradually cease to divide and this is followed by loss of turgidity. plasmolysis, death and desiccation. The plant is really 'roasted alive' due to the peculiar weakness of the root system.

The opinion is expressed by the followers of the infection school, that the physiological origin of spike is only a theory but that its infectious nature has been definitely established. This position is untenable. A theory is not wrong because it has not been proved. In the words of Cedric Dover, who has been working on this disease and accepts the infection theory with some qualification, 'a likely hypothesis is true till it is proved to be true or not' (Indian Forest Records 1932, pp. 37). The physiological theory, therefore, deserves every consideration, in view of the fact, that the only alternative theory, viz., the infection theory cannot be considered as definitely proved for the following reasons.

II. THE INFECTION THEORY

Sandal is nothing if not a parasite. It is a decided plurivore, capable of attacking very many hosts, and, under forest conditions, depends on the roots of a number of plants for water and nutrient salts, in addition to what it can gain directly from the soil. The minute anatomical studies of Barber and the field observations of Rama Rao and other workers notwithstanding, no one is at present in a position to state, with certainty, whether any one host, or family of host plants, will carry the sandal plant through, in its entire life cycle of 50 to 100 years. One thing is however certain that for a restricted relationship to be possible, the ideal host or hosts must be perennials, as long-lived as the sandal, and must satisfy the conditions of parasitism for a lasting relationship to be established, as in the case of certain parasites of the Striga and the Orobanche groups, for instance, which are by preference, confined mostly to the Gramineae and Solanaceae, respectively. It is therefore open to question whether any of the hosts employed like Acacias, Albizzia, Butea, Cajanus, Divi-Divi and Pongamia amongst Leguminoseae, Azadirachta, Dodonaea, Lantana, Melia, Strychnos, Zizyphus, etc., amongst other families have each by themselves really proved satisfactory hosts to the numerous research plants on which the grafting experiments have been conducted. Barber's anatomical studies rather point to tropical Leguminoseae and Zizyphus at least being anatomically unsuited to serve as hosts.

It must also be borne in mind that the mere presence of, or attachment by haustoria is no proof that a successful union has been effected, for the haustoria are formed by mechanical contact, rather than through any chemical stimulus, and they fail to function as absorbing organs in all cases, where the hosts are of an unprofitable nature and wither.

Considering therefore, that none of the plants employed as hosts in the pot cultures, have been ascertained to be good, grafting is a very doubtful method of investigating the problem, where, every sandal stock employed, is in a state of pot culture associated with a host of doubtful utility, and for this reason, the physiological condition of the stock is equally doubtful. The results obtained could only be interpreted, as proving that wherever spike has been produced, the hosts employed are unsuited or have not been successfully parasitised and in the case of others, they have served as good hosts so far, though nothing like a positive inference can be drawn, as under field conditions, not the meanest herb but may still function as a host of some value and do its bit of service to the parasite through its rootlets. This may perhaps be illustrated by the following equation, where S stands for sandal and other letters for the different hosts S=A+B+C+... In the latter combination, the presence of a few useless hosts does not matter so long as there are others, on which sandal can have a good start and may depend on them and on others. It may be remarked that Lantana has earned such a notoriety in connection with spike firstly because sandal is unable to establish lasting connection on its roots, secondly, Lantana dominates to the exclusion of other tree species, which may serve as useful hosts, and, thirdly like any other weed which affects a crop, it deprives sandal and other plants of a great deal of water supply from the soil.

In view of the above considerations, grafting as an experimental method in substantiating the infection hypothesis, in the case of this particular disease, seemsfundamentally unsound. The hypothesis itself cannot work satisfactorily. It fails to explain among other things, why. if the disease spreads above ground by means of an unknown vector, the infectious principle does not kill the shoots, but the haustoria and the root ends die first, spike manifests itself only later and spiked shoots continue to live until the last stages are reached, carrying on all the vital functions, viz., absorption, transpiration, respiration and growth.

It may not really matter which theory is correct, if it is only within the region of academic discussion. When it passes this limit, the consequences need examination. As the acceptance of the infection theory involves adoption of remedial measures, like removal or destruction of valuable trees which is not contemplated by the physiological theory, the above objections should be carefully considered by the followers of the infection school, before they take the disease as definitely communicable.

II

Time of Irrigation of fruit trees.

Mr. Rajam Row, Courtallam, writes:

Is there any principle as to when trees should be irrigated. e. g. Orange and lime trees have tender shoots and blossoms are appearing. At that time could irrigation be had. Is it good or injurious? In the next stage berries will get in. Is watering them necessary ? At what stages should the trees be watered.

Mr. R. Swami Rao, Superintendent, Central Fam, Coimbatore, answers as follows:-

Adverting to your letter asking for some information regarding the principle as to when trees should be irrigated, I have to state, based on my experience of the orange belt of North Arcot and Chittore and Cuddapah Districts, that no irrigation is given to fruit trees, especially to orange and lime trees at the time of their flowering or blossoming. Irrigation is however continued after the formation of berries.

If irrigation is given at the time of flowering there is a tendency for the flowers to drop down, as vegetative growth is stimulated resulting in the plant trying to give up its unessential parts viz. the flowering parts. This is very common in the case of cultivated crops, chiefly cotton, which sheds its flower buds in cloudy and rainy weather, the only exception, perhaps being chillies. For the same reason rains in the flowering season of mango trees are considered detrimental to the yield.

Gleanings.

Growth of Plants Stimulated by X-Rays. X-Rays can cause plants to grow faster, blossom earlier, form more chlorophyll, and in general speed up their life processes. But if they get too much of a dose of the rays, they become crippled. This in brief summary is what Prof. C. A. Shull, of the University of Chicago, has found in experiments which he reported at Atlantic City before the meeting of the American Society of Plant Physiologists.

Prof. Shull exposed corn, wheat, oats and sunflowers to X-rays for periods of from one to five minutes, inclusive, under screens to take out the harmful parts of the X-ray spectrum, and also for ten minutes without the benefit of screening. He compared the growth of these plants with "control" plants that were not X-rayed at all.

All the rayed plants except the ten-minute lot apparently were stimulated by the treatment. In some cases they became juicier, or more succulent, as well as larger. In corn a considerable increase of the green food-making substance, chlorophyll was noted, running from 20 to 60 per cent. above the controls. X-rayed seeds carried on their respiratory processes with greater energy, the data indicating from 30 to 50 per cent. increase.

The three-minute treatment seemed to be most beneficial especially in the case of the sunflowers. Pots of the young plants ranged side by side mark off a curve with the graduated heights of their tops: good at one minute, best at three, not so good at five, and disastrous for the ten-minute treatment without a screen. The plants were in bud at about the same time, but the three-minute group blossomed first.

The condition of the ten-minute group indicated emphatically the effects of too much of a good thing. It was badly burned, and pecked all over the leaves, as though with a mosaic disease. The leaves were irregularly lopsided, an effect not observed at all in the plants given shorter rayings under screens (*Science* Vol. 77, No. 1984. Jan. 6, 1933).

Poisons—Their Treatment and Antidotes. Since practically all of the chemicals used in control work are poisonous to man and beast, great care has to be exercised at all times in their use and storage. However, under the best of management mistake or accident will some time occur. In such instances, emergency procedure must always be adopted because every moment becomes exceedingly precious, and while the doctor is on his way, much can be done, if one knows how, that will usually spell the difference between life and death. For this reason all packages containing poison must show conspicuously on the outside the usual symbol of such, together with the word POISON plainly marked. As well as this, the antidote and treatment for such poison or poisons present must be given.

Following is a list of the common poisons and their respective antidotes as given in the regulations:— (1) *Mineral Acids:* Sulphuric, hydrochloric, nitric and acetic acids. *Antidote*: No emetic. Give very concentrated lime water, chalk, calcined magnesia, soap suds afterwards, raw eggs, milk, sweet oil. (2) *Acid* Oxalic. *Antidote*: No emetics. Give concentrated lime water, wall plaster in paste with water, chalk, afterwards castor oil. (3) *Alkalis*: Lye, sodium hydroxide, potassium hydroxide, ammonia water, etc *Antidote*: Vinegar, dilute citric or tartaric acids, lemon or orange juice, then raw eggs, sweet oil, barley water, stimulants. (4) *Arsenic* and all compounds containing arsenic. *Antidote*; Emetic promptly, syphon tube cautiously inserted, milk, and emetic of mustard water, hydrated ferric oxide; followed by raw eggs, milk, mucilageneous drinks. (5) *Cyanides*: All compounds of hydrocyanic or pussic acid. *Antidote*: Syphon tube or emetics, cold applications to head and neck, aromatic sprits of ammonia, smelling salts, artificial respiration, brandy (per rectum), prevent sleep. (6) *Copper*: All compounds of copper. *Antidote*: Emetics, baking soda, then white of eggs, milk, sweet oil. (7) *Fluorides*: All compounds containing fluorine. *Antidote*: Calcium compounds, preferably 1% solution of calcium chloride, lime water. (8) *Formaldehyde*, Formalin, etc. *Antidote:* Ammonium acetate solution, or well-diluted ammonia water. (9) *Iodine*. *Antidote*: Emetics aided by demulcent drinks, starch and flower paste, raw eggs. (10) *Lead*: All compounds of lead. *Antidote*: Emetic epsom salts in large doses, stimulating drinks, potassium iodide. (11) *Mercury*: All compounds of mercury except corrosive sublimate. *Antidote*: Immediate emetic, then white of raw eggs, milk, gruel, barley water, flour and water. Give patient all he can swallow. (12) *Corrosive sublimate*: No emetic. Give white of raw eggs and milk in large quantities. (13) *Phosphorous*. *Antidote*: Stomach tube, emetics, copper sulphate both as antidote and emetic (3 grains in water every five minutes till vomiting is induced) half-ounce of epsom salts, no fats or oils. (14) *Phenols*, Carbolic acid, etc. *Antidote*: Cautious insertions of syphon tube and wash out stomach with epsom salts solution, afterwards, olive oil, milk, castor oil, brandy, and warmth. (15) *Strychnine*. All compounds. *Antidote*: Emetics, strong tea, potassium bromide; keep patient still, give chloroform to prevent spasms. (16) *Sulphides*: Carbon disulphide, potassium and sodium sulphide, etc. *Antidote*: Syphon tube and wash out stomach, or 3 grains of copper sulphate in water as emetic. Afterwards milk, eggs, warmth, artificial respiration, if necessary. Alcoholic stimulants per rectum. (17) *Tobacco*: Extracts of tobacco, nicotine, etc. *Antidote*: Syphon tube or emetic, prone position, strong coffee or tea, warmth to extremities. (18) *Turpentine*. *Antidote*: Emetic, milk. (19) *Zinc*: All compounds of zinc. *Antidote*: No emetic, large doses of baking soda or washing soda dissolved in warm water, milk and eggs freely, strong tea. (*From Bulletin 351, April 1930, Ontario Department of Agriculture*).

Do Living Tissues emit Rays? One of the most striking of recent suggestions is that radiations may be accompaniments of certain cellular activities, and may produce effects at a distance. Thus a Russian biologist, Gurvitsch, claims to have shown that when growing cells divide, they emit rays which accelerate the processes of division in other cells. To these suggestions, Sir Frederick Gowland Hopkins gave enhanced interest, by his provisional appreciation in his Anniversary Address to the Royal Society last November. He said: " Work by many during the last year seems to have brought satisfactory proof that chemical reactions in living tissues are indeed accompanied by radiations, and events in one cell may thus influence other cells without material transmission '. " That activities in living cells may be accompanied by radiations recognisable by physical means is now, I think, a fact which is proved." It may be that this clue will lessen the uniqueness of cell-division. It certainly leads us to look at the glow-worm with fresh interest. *Scottish Jour. of Agri.* Jan 1933.

Bamboo Artificial Silk. " Experiments are being made at the Forest Research Institute at Dehra Dun, India, to produce art silk from bamboo pulp, and it is understood that partial success has already been attained. Cellulose was prepared from *Ochlandra Travancoria* (*eeta* bamboo) conforming to the specifications demanded by the artificial silk industry, but the preparation fell short to some extent of the necessary requirements. The maximum percentage of α—cellulose, which is the most important constituent in cellulose for the manufacture of artificial silk, is only 89—90 in bamboo pulp; the percentage of ash in bamboo pulp is also high, i. e., 0·3 % as against 0·1 % to 0·2 %, the maximum required in cellulose for artificial silk. Further experiments at the Dehra-Dun Forest Research Institute are in progress from which it is confidently hoped that it will be possible to attain the necessary high percentage of α—cellulose and also to reduce the ash percentage. The successful solution of the problem would encourage the establishment of a new and important industry in India and provide an additional outlet for the utilisation of bamboos. (*Jour. Soc. Chemistry and Industry*. 1932, Vol. 51, pp. 864—865.)

The oldest living tree. A report states that the "Grizzly Giant" tree of Yosemite National Park in America is now considered the oldest tree living. Its height is 209 feet and its age is estimated at more than 3,800 years and recent measurements taken of the "Grizzly Giant" reveal that it would make 363,600 board feet of lumber—(*Indian Forester*, March 1933).

Crop and Trade Reports.

MADRAS REPORTS

Cotton Crop Report, Madras, Fifth or Final Report. On an average of the five years ending 1930, the area under cotton in the Madras Presidency has represented 8·9 per cent of the total area under cotton in India. The figures in this report relate to the cotton crop sown between April 1932 and March 1933. (Estimates up to the 25th March 1933.) (1) The area sown with cotton in 1932-33 is estimated at 1,976,100 acres against 2,255,200 acres for the corresponding period of last year and 1,956,100 acres in the February forecast of the current year. The present estimate for the Presidency represents a decrease of 11 per cent. from the finally recorded area of 2,228,340 acres in 1931-32. Last year's estimate exceeded the actuals by one per cent. (2) Picking of cotton is in progress and will be finished by the end of this month. (3) A normal yield is expected in Ganjam, East Godavari, West Godavari, South Arcot, North Arcot. Coimbatore, Tanjore, Ramnad and the West Coast, a yield below normal is expected in the other districts especially Guntur (75 per cent.), Bellary and Anantapur (80 per cent.). Leaf curl disease in Guntur and drought in Bellary and Anantapur are responsible for the low estimates in these districts. The season factor for the Presidency works out to 98 per cent. of the average for irrigated cotton and 89 per cent. for unirrigated cotton, the final figures for the last year being 104 per cent. and 84 per cent. On this basis, the yield works out to 411,600 bales of 400 lb. lint against 423,610 bales in the previous year, a decrease of about three per cent and against an average of 527,100 bales. It is however too early to estimate the yield with accuracy as much will depend on future weather conditions and their effect on the second crop and on the amount of damage done by insect pests. (4) The estimated area and yield under the several varieties are given below :— (Area in hundred of acres, yield in hundred of bales of 400 lbs)

Variety	Area in		Yield in	
	1932—33	1931—32	1932—33	1931—32
1	2	3	4	5
	Acres	Acres	Bales	Bales
Irrigated cambodia	183,7	151,2	111,9	92,9
Dry cambodia	141,2	129,7	28,6	26,9
Total cambodia	324,9	280,9	140,5	119,8
Karunganni in Coimbatore	114,5	114,9	26,7	27,2
Uppan in the Central Dts.	41,3	47,3	6,1	7,2
Nadan and Bourbon	40,0	37,0	2,0	1,8
Total Salems	195,8	199,2	34,8	36,2

Tinnevellies (a)	507,7	548,4	129,7	140,0
Northerns & Westerns	770,0	1,037,5	79,5	99,6
Coconadas	158,9	170,2	24,8	30,1
Others	18,8	19,0	2,3	2,4
Grand Total	1,976.1	2,255,2	411,6	428,1

(a) Includes uppan, karunganni and mixed country cotton in the South.

(5) The table below gives final information, as far as it is available on the crop of 1931—32.

(Figures in hundred of bales of 400 lbs. lint,)

Particulars.	South		Deccan	Rest of the Presidency	
	Tinnevellies and Salems.	Cambodia	Northerns & Westerns	Cocanadas and others	Total
1	2	3	4	5	6
	bales	bales	bales	bales	bales
(1) Pressed at presses *plus* loose cotton received at mills in 1932—33	148,4	149,8	101,0	38,2	437,4
(2) *Add* estimate of extra factory consumption in 1932—33	6,0	nil	6,0	4,0	16,0
(3) Total crop of 1931—32	154,4	149,8	107,0	42,2	453,4
(4) Yield as estimated in April 1932	176,2	119,8	99,6	32,5	428,1
(5) Yield as estimated in the season and crop report	166,8	126,8	98,3	31,7	423,6

Note Item (1) The entries mainly relate to the crop of 1931—32. The early sown crop in the Deccan, however, generally comes into the market from December in each year. The figures are taken from the weekly returns furnished by mills and presses.

Item (2) The figures are approximate.

(3) Figures of carry over of crop and arrivals and despatches are not available.

6. The wholesale price of cotton lint imperial maund of 82 $\frac{2}{7}$ lb. as reported from important markets towards the close of March 1933, was Rs. 14—12—0 for Cocanadas, Rs. 16—8—0 for red northerns, Rs. 19—6—0 for white northerns, Rs. 13—15—0 for nungari (early crop) westerns, Rs. 19—3—0 for cambodia, Rs. 17—12—0 for Tinnevelly karunganni cotton Rs. 16—3—0 for nadan cotton, and Rs. 16—15—0 for Tinnevellies cotton. (*From the Board of Revenue, Madras*).

Gingelly Crop Report, Madras, Fourth or Final Report. (On an average of the five years ending 1930-31, the area under gingelly in the Madras Presidency has represented 12·5 per cent. of the total area under gingelly in India. The figures in this report relate to the gingelly crop sown between April 1932 and

March 1933). (Estimates up to the 25th March 1933). (1) The area sown with gingelly up to the end of March 1933 is estimated at 806,400 acres as against the estimate of 757,200 acres for the corresponding period of last year and the final recorded area of 747,053 acres last year. The estimate for this year is 8 per cent. above last year's actuals. Last year's estimate exceeded the actual area by one per cent. (2) 171,900 acres have been reported as sown since the previous forecast report was issued in January. as against 215,300 acres during the same period last year. These late sowings were mainly on wet lands in the Circars and the South where gingelly was raised as a second crop after paddy (3) There has been an increase in area except in Vizagapatam, Kistna, Bellary, Cuddapah, South Arcot, Ramnad, Tinnevelly and the West Coast. (4) The yield has been normal except in Ganjam, Vizagapatam, South Arcot, Chittoor, North Arcot, Tanjore and Tinnevelly where it has been below normal. The condition of the late sown crop is generally fair. (5) The seasonal factor for the Presidency works out to 97 per cent, of the average as against 96 per cent in the previous year. On this basis. the yield is estimated at 106,500 tons as against 96,510 tons in the previous year and an average yield of 107,570 tons. (*From the Board of Revenue, Madras*).

ALL INDIA FORECASTS

Final General Memorandum on the Sugar Cane Crop of 1932-33. The area sown is estimated at 3,305,000 acres, as against 2,972,000 acres, or an increase of 11%. The total yield of raw sugar (*gur*) is estimated at 4,651,000 tons, which exceeds the last years, record yield of 3,970,000 tons by 17%. The condition of the crop is reported to be good. The contributions of the different provinces to the total yield of cane and the acre yields are as follows. *United Provinces*—sown 1,789,000 acres 52·1% of total area yield 2,602,000 tons, acre yield 3,258 lbs. *Punjab*—sown 556,000 acres, 14·4% of total area, yield 415,000 tons, acre yield 1,672 lbs. *Bihar and Orissa*—sown 302,000 acres, 9 9% of total area, yield 313,000 tons, acre yield 2,322 lbs. *Bengal*—sown 233,000 acres, 7% of the total area, yield 454,000 tons, acre yield 4,365 lbs. *Madras*—sown 125,000 acres, 3 6% of total area, yield 346,000 tons, acre yield 6,200 lbs. *Bombay*—sown 101,000 acres, 3·2% of total area, yield 264,000 tons, acre yield 5,855 lbs. During the nine months April—December 1932, 278,285 tons of sugar were imported from foreign countries, mostly from Java (232,002 tons) and United Kingdom 23,551 tons, as against a total import of 375,271 tons in the corresponding nine months of the previous year. The annual imports of sugar have fallen from 937,662 tons in 1927-30 to 893,404 tons in 1930-31 and to 515,266 tons in 1931-32. The worlds production of sugar, both cane and beet, during 1932-33, is estimated at 23,854,000 tons, showing a decrease of 2,263,000 tons (1,678,000 tons in the case of cane sugar and 585,000 tons in the case of beet sugar), as compared with the preceeding season.

Final General Memorandum of the Cotton Crop of 1932-1933. The total area reported is 22,350,000 acres as against 23,482,000 acres, the revised estimate at this date last year, or a decrease of 5%. The total estimated yield now stands at 4,425,000 bales of 400 lbs. each, as compared with 4,088,000 bales (revised) at the corresponding date of last year. or an increase of 8%. The condition of the crop, on the whole, is reported to be fair. The provincial contributions towards the total area and yields and acre yields are as follows. *Bombay*—28·7% of total area, sown 6,395,000 acres, yield 1,405,000 bales of 400 lbs., each, acre yield 88 lbs. *Central Provinces and Berar*—19·4% of total area, sown 4,216,000 acres, yield 740,000 bales, acre yield 70 lbs. *Punjab*—10·2% of total area, sown 2,268,000 acres. yield 622 bales, acre-yield 110 lbs. *Madras*—9% of the total area, sown 1,956,000 acres, yield 420,000 bales, acre yield 86 lbs. *United Provinces*—3·1% of total area. sown 527,000 acres yield 170,000 bales acre yield 129 lbs. *Hyderabad*—14·2% of total area, sown

3,593,000 acres yield 533,000 bales. acre yield 59 lbs. *Central Indian States*—5·1 per cent. of total area, sown 1,020,000 acres, yield 139,000 bales, acre-yield 55 lbs. The distribution of the total Indian cotton crop under the different trade forms is as follows. *Oomras*—area, 10,223,000 acres, yield 1,660.000 bales, acre yield 65 lbs; *Dholleras*—area 2,586,000 acres, yield 642,000 bales, acre yield 99 lbs; *Bengal Sind*—area 2,787,000 acres, yield 752,000 bales, acre yield 108 lbs; *American*—area 862,000 acres, yield 224,000 bales acre yield 104 lbs; *Broach*—area 1,276,000 acres, yield 296,000 bales acre yield 93 lbs; *Coompta-Dharwars*—area 1,401,000 acres, yield 213,000 bales, acre yield 61 lbs; *Westerns and Northerns*—area 1,591,000 acres, yield 202,000 bales, acre yield 51 lbs; *Cocanadas*—area 189,000 acres, yield 32,000 bales, acre yield 68 lbs; *Terenevellies*—area 453,000 acres, yield 125,000 bales, acre yield 110 lbs; *Salems*—area 193,000 acres, yield 35.000 bales, acre yield 73 lbs; *Cambodias*—area 320,000 , yield 141,000 bales. acre yield 176 lbs; During the five months September 1932 to January 1933, for mill consumption Bombay consumed 492,543 bales, Madras 124.956 bales, United Provinces 116,621 bales and the Central Provinces and Berar, Bengal, Punjab and Indore about 40,000 to 50,000 bales each, the total mill consumption for India were 1,042,227 bales and exports to foreign countries 836,000 bales during the five months September 1932 to January 1933.

Trade and Economic conditions in India. The position, broadly speaking, is that, after an initial rise, prices towards the end of the period under review showed again a falling tendency, with the result that although the average level of prices on the basis of which, India's exports during 1932 were sold is slightly higher than during 1931, the general level of prices at the end of the year had fallen below the average. The most that one can say is that countries linked to sterling have fared much better than those which are still on a gold basis.

Exports. The results of the further deterioration in the general world position are reveled in India's export figures which for the ten months April to January showed a total value of 110½ crores as compared with 134¾ crores for last year. In the case of practically all the main items the decline is accounted for by a fall in the quantities rather than the price of the articles exported. This is true of the following decreases. Cotton exports 6½ crores. Jute 1¾ crores. grain, pulse and flouer about 2 crores, seeds just over 2 crores. The only exception to this under the major heads of exports is the case of tea where a slight increase in the quantity exported has been accompanied by a fall of 3 crores in value.

Raw cotton is by far the worst sufferer and during 1932 the exports had fallen in quantity by more than a half a fall which as a result of the lower prices is increased to one of more than three quarters in value as compared with the average of the past ten years For Jute, the fall in volume was about a quarter while the fall in value is more than a half In the case of tea, although the volume of export was more than maintained, the value was reduced by more than a third. In the case of rice, the volume of export was maintained, but the value fell by over 50 per cent. Groundnuts on the other hand show an increase in quantity but a decline in value.

Imports While the value of India's exports had thus further declined this year as compared with the last, the cause as regards imports has been strikingly different. For these at 112¾ crores for the first ten months of the current year, show a rise of about 7½ crores on the corresponding ten months of last year. Here again an examination of the actual changes in the case of the main articles of importing is interesting and suggestive. By far the largest item is the increase of just over 7 crores in cotton piece goods and yarns It may perhaps be said that in this case exceptional factors have come into play, because the preceding period with which it compares, influenced as it was by non-economic factors such as the boycott, can hardly be regarded as normal. The important fact to remember however, is that this increase in imports of cotton piecegoods was accompanied by a striking growth in the production of Indian mills which according to Dr. Meeks figures increased by about 11 per cent. or 284 million yards in the first 11 months as compared with 1911. It must also be noted that there has been a marked increase in the imports of other piecegoods, woollen, silk, artificial silk, and mixtures.

The increase in Indian production of cotton goods accounts for the next interesting item of increased imports on which I must comment, namely, of raw cotton, which at 6·36 crores are 79 lakhs up on last year. The steady growth during recent years in these imports is most remarkable. Taking the "cotton years" up to August 31 in each case, imports of foreign cotton expanded from just over 20,000 tons, in 1928-29 to 97,000 tons in 1931-32. Another interesting item is machinery where the imports at 9½ crores are only a few lakhs less than last year. Here these would have been of much greater fall if it had not been for a striking increase in the imports of plants for sugar factories, the imports of which in the nine months to the end of December amounted in value to 138 lakhs as compared with 30 lakhs last year and only 9 lakhs in 1929-30 In the case of certain other machinery too there have been increases which are encouraging. Thus, taking the full calender year 1932 as compared with 1931, cotton machinery increased from 180 to 208 lakhs while tea, jute and wool machinery increased by 13·3 and 1 lakh respectively.

These are the chief items of expanding imports. As against this, I must comment on the two most striking examples of declines. Imports of foreign sugar at 3·66 crores are down by 1 crores. This indicates the continuance of a steady process of decline in the value of sugar imports which for 1930-31 was about 9 crores, and in 1929-30 about 14 crores. The decline may be partly due to decreased purchasing power as evidenced by decreased consumption of refined white sugar, but I think it is a fair appreciation of the position to say that it is mainly due to the increase of Indian production. I explained last year that we estimated the production of Indian sugar to be increasing at the rate of 60,000 tons per annum, and it looks now as if this rate were being considerably accelerated.

Another striking example of decline is the case of vehicles—mainly of course, motor cars, buses and lorries, which at 304 lakhs for the ten months show a decline of 89 lakhs on last year and are less than of the value in 1929-30. (*From the Finance Member's speech on the Budget proposals for 1933-34*).

Association of Economic Biologists.

Problems of Sugarcane Research in the Provinces with special reference to Bihar and Orissa.

Under the auspices of the above Association, Mr. K. L. Khanna, Sugarcane Specialist, Bihar and Orissa, delivered a lecture on the above subject on the 13th March 1933, with Mr. G. N. Rangaswami Ayyangar, the President of the Association in the chair.

The lecturer first explained how the Cane Breeding Station at Coimbatore, was sending out a number of new seedlings for trial in the different provinces and how it took 5 or 6 years to determine which of these seedlings was the best suited to particular local conditions. Since the research schemes financed by the Imperial Council of Agricultural Research were usually for a period of 5 years, and sufficiently promising results are expected to be obtained within this period, it would be profitable, the lecturer stated, if the investigator could devise short cut methods of work in achieving the ends in view. While thinking of short cuts a number of problems suggest themselves and these were referred to by the lecturer.

The first question to be considered was the survey of the different cane tracts. In most provinces regular surveys have already been made of the cane varieties grown in the different parts, and it has been found that only a particular type of cane was the dominant variety of individual tracts so that, these tracts are themselves classified according to the cane variety growing there; as for example, the *katha* tract of Punjab, and so on. A detailed study of the indigenous canes should tell us that it is only the seedlings that possess all the characteristics of the local variety that are likely to succeed in the tract, where that local variety is predominant. Some varieties may be able to grow in water-logged soils and others may require loamy soils, A detailed survey of each cane tract from the varietal point of view would appear to offer promise of fruitful results.

The second consideration might be the study of the meterological conditions obtaining in the different places. Though the weekly records of the meterological data show some differences, when monthly averages are compared, such differences are not apparent in the different parts of the same province. When it is found that a seedling (Co 213) distributed in Bihar did well in one place, and was a failure in another place only 30 miles away, the use of the meterological data to determine the suitabllity of particular seedlings to particular areas does not offer much hope.

The third consideration is the study of the plant itself and its response to the characters of the soil. It has often been the experience that when a seedling variety was tried in two different places, it was found that it developed a much better root system in one place than in the other. The question that naturally arises is whether it would be possible to correlate the morphological data of a variety with the composition of the soil in which it is grown. But the ordinary chemical composition of the soil failed to give any indication to the conditions of growth. It is not known whether it would be possible to correlate definite periods of growth of the plant with the soil analyses. It is probable that the examination of the physical attributes of the soil, its cohesive nature, permeability, etc , rather than the ordinary chemical composition might give an indication to the growth conditions.

In cane, varieties exhibit wide adaptability to the environmental conditions they are grown in. Two seedlings, Co. 33[illegible] and Co. 336, grown in two places where the physical and chemical composition of the soils did not vary, still showed a big variation in their root penetration powers. In one place the penetration force was 10½ lb. and only 5 lb. in the other, though the depth of the soil was the same, very deep, in both the places. Under North Indian conditions where no irrigation is practised for sugarcane, studies on the penetrating power of roots shows a definite relation to the growth phases. When there is too much of moisture in the soil the penetrating force is less, but it increases at the time of maturity (Nov.—Feb.) when there is very little of growth, and the temperature goes down. The availability of food nutrients in the soil may vary under different conditions of soil and this should have something to do with the growth of the cane. If the penetrating force of roots of a certain variety of cane under particular soil conditions were known, the knowledge might perhaps be useful in trying this variety of cane under similar soil conditions elsewhere. The knowledge about the root penetrating force might also be useful in the trial of particular cane varieties, in soils deficient in moisture contents.

While speaking about the sugarcane root system we have to differentiate the sett and the shoot roots. The sett roots which develop first, act as water carriers and function only for a period, which varies with different varieties. The shoot roots develop later and come out in flushes. The shoot roots which develop by the middle of May show little development towards the end of June. After June these roots not only vary in size and penetrating force but also in the period of their functioning. There is probably something in the differences of the root flushes and their functioning period as they regulate the taking in of the food by the plant from the soil. Whether these differences would lead us nearer the short cuts in the methods of attack, or can be utilised for some economic purpose cannot be stated definitely. If we could correlate the differences in the root history of a particular variety grown in ten different places with the different environmental factors, we might be able to get an index as to what a new variety might behave like under these conditions. An attempt was made to see if this could be done with variety Co. 213 grown extensively in Bihar and the studies did give a qualitative index as to what characters a new variety should possess, before it can successfully replace Co. 213.

The next point to consider is the relationship between the differences in the time of root production and the application of manures, as a quicker root growth must mean a quicker response to the application of manures. Although the cultivator may not realise when best to apply the manure, it can be easily demonstrated that the best time to apply the manure is when the new flush of roots are developing. It has been found that an application of 20 lb. of N and 20 lb. of P_2O_5 in relation to the development of the root flushes gave better results than much heavier doses of manuring applied at other periods.

The study of the root system becomes useful in changing the irrigation practices. In Punjab and S. Bihar the irrigation water applied on the surface does not probably reach beyond a depth of 3 feet. Application of water without any relation to the development of root flushes might result in a big loss of water by evaporation from the surface. Irrigation in deeper layers of the soil may probably be more useful. The study of the roots has also shown that they are much stronger when the interval between two irrigations is prolonged. Another utilisation of the knowledge of the root phases comes, in making the crop stand up without lodging. The force required to pull asunder the roots varies in different varieties. This should have a relation to the moisture conditions in the soil. The determination of the pulling strain as an index to see whether the cane crop is going to stand up or [illegible] is not satisfactory because the force of wind has to be measured in terms of pounds at any particular angle, and the force of wind may also vary from time to time and season to season. In one case, Co. 313 requiring nearly 500 lbs. force to uproot the plant lodged when the moisture content of the soil was 37 %. Lodging may in some cases be due to intensive meristamatic activity on the top portion of the crop, and in other cases, to the weakness of the roots, i. e., slower response to moisture conditions. The question of lodging leads us to the question of growing a mixture of varieties, some lodging and others non-lodging. The difficulty in this would be to decide upon the particular varieties to go in combination.

The question whether any part of the cane other than roots can be used as an index of drought resistance requires consideration. The plant has adaptable powers to different environmental conditions. In varieties Co. 285 & 320, during the hot weather in May, the leaves are found to roll inwards much more than in other varieties thus effectively reducing transpiration. Though a certain amount of relationship exists between the respiratory powers of the root and the drought resistance in some varieties of cane, the activity of the root at any moment does not show any relation to the stomata in the leaf and hence to the transpiration rate. Dastur finds a correlation between the osmatic concentration of the leaf and the water requirements of the plant at the critical period of growth in rice. Whether root pressure determined at particular period of growth in cane, would serve as a suitable index remains to be seen. When the cane is planted, it grows slowly first and gradually increases its growth activity. The plant would probably make the most economical use of any manure applied at the time when the plant attains the peak of vitality. The manure applied earlier, when the vitality is low, may not be so useful to the plant.

Lastly, the question of using the meteorological data to work out definte correlations between it and growth phases in cane may be considered. For this work, it may not be enough if the data are recorded at one central station only. It may have to be done at a number of stations and the data used in determining the amount of growth. a cane crop would make, for a given set of weather conditions. If this could be done for definite tracts in each province, it would go a long way in simplifying the methods of breeding work.

At the end of the lecture there was an interesting discussion on the various points touched by the lecturer and he was complimented for his several thought-provoking ideas. K. R.

Review.

World Rice Situation. (*Reprint from the Foreign Crops and Markets: Issued by the Foreign Agricultural Service Bureau of Agricultural Economics, United States Department of Agriculture, Washington Aug. 22, 1932*).

The above reprint gives in brief the world's position of rice for the year 1931—32, its total production, the share of individual countries in it, and the chief countries concerned in its trade. The estimated world rice crop of 1931 outside Russia and China is placed at 131,000,000 lb., a slightly smaller figure than for 1930, but larger than any other of the preceding nine years. Though stocks continued large the prevailing low prices had drawn larger volumes of rice into international trade. Supplies were reduced in Japan and she with China have been heavy buyers in the south-east Asiatic export markets. So far as United States was concerned, the supplies were smaller because of the 1932 reduced crop, and the prices have had to be reduced to keep the movement of rice from the country in competition with Oriental and European rices. The United Kingdom and Germany, especially the latter had taken more American rice than previously. The American supplies to S. America had become reduced because of the supply from Brazil to these parts.

Among the chief rice producing countries of the east, Japan showed a drop of 17 % in production, while India (including Burma) with its large crops was the chief factor in the maintenance of the large world estimate. Regarding Indo-China and Siam, the two other important countries concerned in the production of rice, the out-turn was slightly smaller in the latter while in the former the production has been the largest since 1927. According to the detailed tables given in the report while most of the minor rice producing countries of the world do not show much of variation in the acreage and total out-put since 1910, the main rice producing countries of the east show a marked increase both in acreage and total production. India shows a 14 % increase in production and a 25 % increase in area over 1909—13 figures. The recent increase in area is particularly marked in countries like Korea, Formosa, Java, Phillippines etc.

The prices of rice in the producing countries of Europe and Asia declined very rapidly from August to the end of 1931 The price of Burma rice quoted in

Rangoon during August came down by nearly 45 % during the next February, and similarly in Saigon the fall for the same period was about 26 %. The very low prices offered for the Asiatic rices during the latter part of 1931 and early part of 1932 resulted in heavy exports from these countries. The declines in the prices of Spanish and Italian rices were, however, very much less than the decline in the Asiatic rices. This fall in the price of the Asiatic rices affected the usual American exports to Europe. The table giving the prices of milled rice both in the respective producing countries and in the London market from February 1930 to June 1932 shows a steady decline in the prices of all the rices, and the figures also give some idea of the disparity in the prices of rices produced in the different countries. For example, the prices of the rices (India) Burma No. 2, Indochina No. 1, and American Bluerose were respectively 1·00, 1·07, and 2·14 cents per pound, and the prices of the same in London market were 1·38, 1·35 and 2·56 cents ; i. e., the American rice in England fetches nearly twice the price of the Burma rice.

British India, principally Burma, supplies the United Kingdom with 40 to 50 per cent. of its rice imports, the rest of the quantity being supplied by America and Spain, that supplied by America alone amounting to about 3 million pounds of rice annually. It is stated that there is very little competition between Burma rice and American rice in the London market, the latter evidently being much superior to the former in quality. There are provinces in India other than Burma which produce finer types of rices of as good a quality as the American Bluerose, if not even better. There are quite a number of fine rices grown in S. India and if Madras could export some of these rices to United Kingdom and manage to capture at least a share of the market now held by America and Spain it is sure to bring relief to the rice growers of S. India. This is a question that is certainly worth investigating. Similarly there is a fairly big market for American and Italian rices in Germany and central Europe to the tune of 40 million pounds of rice and the possibility of getting a share of this market also requies consideration. Commercial samples of some of the rices from S. India have already been sent to the Indian Trade Commissioners in London and Hamburg for exhibition purposes, and it is hoped they will draw the attention of the people in the respective countries.

There are interesting tables giving the exports of rice in husk, cleaned rice, boiled rice etc , from British India to specified countries in the east as well as to countries in Europe for the years 1927 to 1932. Of the total exports from India nearly half goes to the countries within the British Empire. So far as the share of the different provinces of India are concerned in this export, Burma contributes 86 5 per cent Bengal 5·8 per cent, Madras 4·6 per cent. and all the other provinces put together 3·1 per cent. (K. R.)

College News and Notes.

Students Corner. The B. Sc. degree examinations for the three parts started during the month, and with a welcome break during Easter, the practicals in the several subjects are going on vigorously. With the examination fever on, there was a lull in athletic activities but more than passing interest was provided by the Badminton Tournament, organised by the Imperial Sugarcane Station staff club at Chettipalayam, for which a number of teams from Tanjore, Trichy, Salem, Palghat and other places in the presidency entered. All the matches attracted huge crowds from Coimbatore town and the finals were played off on Saturday the 22nd, M. R. Ry. Rao Bahadur A. V. Govinda Menon, B. A., B. L., District Judge, Coimbatore presenting the trophies to the winners and runners up.

On Sunday 23rd April, a public meeting was arranged under the auspices of the Madras Agricultural Students' Union, at which speeches were made bidding farewell to the final year students and wishing them all success in their future career, and impressing on them the necessity for keeping an abiding interest in the Union; an impressive ceremony was gone through, the students one by one signing their autographs in an album especially prepared for the occasion, after which they were each presented with a momento by the president of the Union.

The Bangalore Science Meeting. About a dozen officers and students mostly from the Chemistry section attended during Easter, a joint meeting of the Indian Chemical Society and the South Indian Science Association at Bangalore, contributing several papers for the occasion.

Dr. Patel, Oil seeds Specialist attended at Simla, a meeting of the Indian Oil Crushing Committee of the I.C.A.R.

The Late Dr. Barber. Under the auspices of the Madras Agricultural Students' Union, a meeting of the residents of the Agricultural Colony was held in the College Hall on Wednesday the 15th March to express condolence at the passing away of Dr. C. A. Barber, formerly Government Botanist and Government Sugarcane Expert. A large gathering was present and several spoke movingly of the great qualities of the late Dr. Barber. A resolution of condolence was passed and the secretary of the Union was authorised to communicate the rosolution to Mrs. Barber.

Visitors. In connection with the University examinations Dr. C. J. George, Professor, Wilson College, Bombay, Mr. V. Krishnamurthy Iyer, Principal, Veterinary College, Madras, Rao Sahib C. S. Ramachandra Iyer, Assistant Industrial Engineer and Dr. Sahsrabudhe G. A. C., Bombay, visited the Institute during the month. M. R. Ry. Rao Bahadur M. R. Ramaswami Sivan, Retired Principal, Agricultural College, and Mr. R. Ramaswami Iyangar, Assistant Secretary, Development Department, were here with us for a few days during Easter. Mr. V. S. Ratnasabapathy, Organising Scout Secretary accompanied by Mr. V. C. Subbiah Gownder, District Scout Commissioner, paid a flying visit to the Estate on 19th.

Fieldmen Association. At a meeting of the above Association presided over by Mr. M. S. Purnalingam Pillay a resolution was passed, expressing condolence on the death of Mr. C. Rangaswami, Fieldman, of the cotton section who passed away after a protracted illness.

Departmental Notifications.

II Circle. B. V. Ramana, A. A. D. Guntur, l. a. p. for 12 days from 6—3—33 to 17—3—33. S. Sitapathi Rao, A. A. D. Nellore, l. a p. for 16 days from 20—4—33 to 5—5—33 with permission to affix the holidays from 13th to 19th April, and suffix the holidays on 6th and 7th May '33. A. K. Annaswami Iyer, A. D. Kandukur, for l. a. p. for 12 days from 20—4—33 to 1—5—33 with permission to affix the Easter holidays. **III Circle.** P. Subrahmanian, A. D. Siruguppa, extension of five weeks l. a. p. on m. c. in continuation of leave already granted. A. Venkobacharlu A. A. D. Dronachalam, l. a. p. for one month from 23—3—33. **VI Circle.** K. Krishnan, A. D. Tinnevelly, extension of l. a. p. for 3 days in continuation of leave already granted. A. M. Muthiah Nattan, A. D. Dindigul, l. a. p. for 11 days from 19—3—33. **VII Circle.** A. Gopalan Nair, F. M. extension of l. a. p. for one month from 3—4—33 in continuation of leave already granted. E. Achutha Nair, A. F. M., l. a. p. for 2 months from 3—4—33. C. S. Madiah on expiry of leave is to join duty at Cannanore, as A. D. on 1—4—33. K. M. Jacob to Taliparamba as F. M K. S. Ramanna Rai, A. D. Mangalore, l. a. p. for one month from 20—4—33 with permission to prefix Easter and other public holidays. **VIII Circle. Transfers:** A, K. Ramasubba Iyer, A. D. Annur, to relieve P. K. Parameswara Menon, A. D. Gobichettipalayam, and will be in additional charge of Gobichettipalayam. P. K. Parameswara Menon, A. D. Gobichettipalayam will relieve H. Srinivasa Rao, A. D. Erode. H. Srinivasa Rao, A. D. Erode will relieve M. Subrahmania Pillai, A. D Tiruppur. L. Krishnan from Palur, to Palladam sub-circle with headquarters at Palladam A D. Coimbatore will report to D D. VIII Circle. P. P. Syed Muhamad to Tiruppur for training in office and district work and for assisting the A. D. Tiruppur in cotton ginning. T. K. Thangavelu to Gobichettipalayam sub-circle. He will however, work under the A. D. Annur for three months. **Paddy Section.** C. V. Sankaranarayana Iyer Sub-Assistant l. a p from 7th to 12th April with permission to avail on the 13th and Easter holidays. C. Rajasekhara Mudaliar l. a. p. for 15 days from 28—3—33 with permission to avail Easter holidays. V. M. Ramunni Kidavu F. M., l. a. p. for 14 days from 29—3—33 with permission to avail 12th April, being holiday and the Easter holidays. **Cotton Section.** V Gomathinayagam Pillai, Assistant in Millets l. a. p. for 14 days from 30—3—33 with permission to suffix the holidays. G. J. Balaraj, A. F. M., A. R. S. Koilpatti, l. a. p. on m. c. for 17 days from 20—3—33 with permission to avail Sunday the 19th March. P. K. Natesa Iyer F. M., A.R.S., Koilpatti l. a p. on m. c. for 2 months and 10 days from 24—2—33. **Principals' Office.** K. Ratnavelu, A. F. M. central Farm, l. a. p for one month from 24—3—33. **Agricultural Chemist's Section.** G. Ganapathy Iyer, Assistant, l. a. p. for 20 days from 24—3—33 with permission to suffix the Easter holidays. **D. A's. Office Orders.** The following postings of Upper subordinates, Agricultural section, are ordered from 1st April: A. Chinnathambi Pillai, A. D. IV Circle to be A.D. VI Circle R. Ananda Padmanabha Pillai, A.D. VI Circle will continue to officiate till further orders. P.P. Syed Muhamad, F M. Central Farm, will be considered to have been officiating as upper subordinate from 20th to 31st March 1933. D. Achyutha Rama Raju, F. M. Guntur to III Circle. M. Satyanarayanamurthi, A. D. Amalapuram to Vizagapatam Division, I Circle, to report himself for duty to A. D. A. Vizagapatam Upper subordinate postings in both the Science and Agricultural sections are ordered. K. Kumaraswami Chetty officiating Upper subordinate, Agricultural section doing duty in the Oil Seeds Specialist's section to Science section to officiate as Assistant, Oil Seeds Specialist section in the permanent post declared temporary. M.J. David, officiating Assistant, Mycology section to continue as Assistant, in the Mycology section vice, K. M. Thomas on other duty. R Ananda Padmanabha Pillai, offg. A. D., VI Circle to continue to officiate in the VI Circle. M. Satyanarayanamurthi, offg. A. D. Vizagapatam to continue to officiate as A. D. in the I Circle till 31st March 1933. D. Achutarama Raju, offg. A. D., III Circle, to continue to officiate as A. D. in the III Circle till 31st March 1933. N. K. Thomas, offg A. D., VIII Circle, to continue to officiate in the same circle vice, K. Ramanatha Iyer. T. K. Mukundan, offg. F. M. Palur, to continue to officiate as F. M. till 6—7—33. S. Rajaratnam Chetty, offg. A. D. in VIII Circle, to continue to officiate in the same circle. A. Muhamadali, offg. F. M. Palur, to continue to officiate as F. M. till further orders. V. K. Appaji, offg. F. M., Kalahasti, to continue to officiate till further orders. L. Krishnan, offg., A. D., VIII Circle to continue to officiate in the same circle till 10th May 1933. T. K. Thangavelu, offg. F. M., Botanical Gardens Ootacamund, to VIII Circle to officiate as A. D. till further orders. P. P. Syed Muhammad, offg. F. M. Central Farm, to VIII Circle to officiate as A. D. till further orders. C. V. Sundaram Iyer, Entomology Assistant, l. a. p. for 2 months from 20th April with permission to prefix the holiday on the 13th and the Easter holidays from 14th to 19th April, 1933.

ADDITIONS TO THE LIBRARY

FEBRUARY 1933.

A. Books.

1. Farm Management Research Technique. *R. Mcg. Carslaw.* 2 Cattle Farming in South Africa. *A. M. Bosman.* 3. Physiological & Genetical Aspects of Sterility in Domesticated Animals. *W. Orr & F. F. Darling.* 4. Proceedings of the Second Pan-Pacific Congress—1923, Vols. I & II. 5. Association Theory of Solution and Inadequacy of Dissociation Theory *J. N. Rakshit.* 6. Madras Manual of Special Pay and Allowances (corrected up to 31—12—1932) Vol. I.

B. Reports.

1. Administration Report of the Madras Co-operative Department for 1931–32. 2. Annual Report of the Indian Lac Research Institute for 1931–32. 3 Administration Report of the Department of Agriculture & Fisheries, Travancore for 1930–31. 4 to 8. Annual Reports of the Departments of Agriculture, (a) Seychelles for 1931. (b) Washington Agri. Expt. Station for 1931–32 (c) Advisory Board of Agriculture. South Australia, for 1931-32. (d) Straits Settlements & Federated Malay States Technical Report for 1931. (e) Philippine Bureau of Science for 1931.

C. Bulletins, Memoirs &c.

1 *South Indian Fodders.* Mad Agri. Dep. Bull. 33. 2. *Annual Supplement to the Madras Half-yearly Civil Lists—1933.* Madras Govt. Publication. 3. *Synthetic Colours versus Vegetabl. Dyes.* Bihar & Orissa Ind. Dept. Bull. No. 13—H. I. S. 4. *On Evaporation & Its Measurement* Mem. Ind Met. Dept Vol. XXV—Part IX. 5. *Ind. Forest Records Vol. 17—1. 5, 6.* The Sutlej Deodar; Its Ecology and Timber Production. 6. The Importance of the Origin of Seed used in Forestry. 7. New Cerambycidae from India (Coleoptera). 8 to 14. *Ind. Lac. Res Ins. Pub. Bulletins 5 to 10.* A Report on the State of Lac Cultivation & General Condition of the Lac Industry in Burma. Humidity & Storage of Button Lac. The Effects of Temperature and Humidity on oviposition, incubation and Emergence in the Lac Insect and on the Resulting Lac Crop. Orpiment and the Iodine Value of Shellac. The Iodine Value of Shellac. Comparative Study of Lac Hosts with Special Reference to Acacia Catechu & Cassia Florida. The Influence of Orpiment in Shellac on the Protective Properties of the Varnish. 15. Survey of Oilseeds & Vegetable Oils. *Emp. Mar. Board No. 61.* 16 to 18. *Min. Agri. & Fish Bull. 30, 57 & 63.* Rats and How to Exterminate them. Butter, Cream, Cheese and Scalded Cream. Fish Meal as a Food for Live Stock. 19. Nutrition in Relation to Reproduction with Special Reference to Sterility in Farm Animals *Imp. Bur. Ani. Nutri. Tec. Comm. 2.* 20 to 22. *Imp. Bur. Agri. 'Parasitology Notes & Memoranda Nos. 7, 8 & 9.* Helminthology in its Application to Live Stock. Helminthology in its Application to Agriculture & Horticulture. Helminths in the Biological Control of Insect Pests. 23. Report on Agricultural Meteorological Conference—1931. *Min. Agri. & Fish. Eng. Pub.* 24. The Inheritanee of Anthocyanin Pigmentation in Asiatic Cottons. *Emp. Cot. Gro. Cor. Mem. Genetics.* 25 Cotton Fibers. II. Structural Features of the Wall Suggested by X-Ray Diffraction Analyses and Observations in Ordinary and Plane-Polarized Light. *Reprint Boyce Thompson Research Institute, Vol. 4, No. 3.* 26. Herbarium Organization. *Chicago Museum Technique Series No. 1.* 27. Fifty Common Plant Galls of the Chicago Area. *Chicago Botany Leaflet—16,* 28 to 30. ***Reprint, Taihoku Imp. Univ. Phyto. Lab. 10, 11, 12.*** **On the Relationship Between the Serological Reaction and other Biological Characters of some Putrefactive Phytopathogenic Bacteria. Immunological Studies of Mosaic Diseases: II. Distribution of Antigenic Substance of Tobacco Mosaic in**

Different parts of Host Plants. Physiology & Parasitology of the Fungi Generally Referred to as Hypochnus Sasai Shirai: I. Differentiation of the Strains by Means of Hyphal Fusion and Culture in Differential Media. 31 to 44. *Canada Dep. Agri. Bull. 17 (N S.) 76, 77, 81, 89, 90, 92, 96, 99, 112, 115, 125, 132 & 137.* Hardy Roses: Their Culture in Canada Tobacco—Growing in Southwestern Ontario; A Summary of Ten Years of Experiment at the Dominion Experimental Station, Harrow Ontario. Preserving Fruits & Vegetables in the Home. Smut Diseases of Cultivated Plants: Their Cause & Control. Ornamental Trees, Shrubs, and Woody Climbers. Dehydration of Fruits & Vegetables in Canada. Manures & Fertilizers: Their Nature Functions & Application. The Conversion of Dry Roughage into a Succulent Feed: An Examination of the Sugar Jack Process. Insects of the Flower Garden and their Control. Household Insects & Their Control. Cost of Producing Farm Crops in Eastern Canada. Use of irrigation Water on Farm Crops. Poultry House Construction with General and Detailed Plans. Weeds & Weed Seeds: Illustrated and Described. 45 to 51. *Australia Council for Sci. & Ind. Res. Bull. 62, 64, 65, 66, 69, 71.* A Soil Survey of the Cadell Irrigation Area and New Era, South Australia. The Ripening & Transport of Bananas in Australia. Downy Mildew (Blue Mould) of Tobacco in Australia. The Influence of Growth Stage and Frequency of Cutting on the Yield & Composition of a Perennial Grass—Phalaris tuberosa. An investigation of the Taxonomic & Agricultural Characters of the Danthonia Group. Investigation on Irrigated Pastures: 1. The Yield & Botanical Composition of an irrigated Permanent Pasture under various Systems of Pasture Management. 2. The Chemical Composition of Irrigated Pastures at Wood's Point, South Australia. 52 to 56. *Austria Council for Sci. Pamphlets 25, 29, 30, 31, 32.* Termites (White Ants) in South-eastern Australia: A Simple Method of Identification and a Discussion of their Damage in Timber & Forest Trees. The Possibility of the Entomological Control of St. John's Work in Australia—Progress Report. The Bionomics & Economic Importance of Thrips imaginis Bagnall: with Special reference to its Effect on Apple Production in Australia. A Preliminary Report on Investigations on the Buffalo Fly (Lyperosia—exigua de Meij.) and its Parasites in Java and Northern Australia. The Chemistry of Australian Timbers Part 2—The Chemical Composition of the Woods of the Ironbark Group. (Division of Forest Products—Technical Paper No. 4) 57. *Nyasaland Dep. Agri. Bull. No. 5 (N. S.)* Mosquito Bug the cause of Stem Canker of Tea. 58 & 59. *Union S. Africa Agri. Dep. Sci. Bull. Nos. 80 & 118.* Moulds and Their Control in the Dairy. Pernicious Scale. 60. *Transvall University College T. U. C Bull. 12* Rainfall & Farming in the Transvaal. Part I—A Preliminary Investigation into the Variability of the Rainfall of the Transvaal. Part II—Rainfall in Relation to Agriculture in the Transvaal. 61. *Univ. of Pretoria Bull. No. 20.* Digestibility of Teff Hay, Maize Oil Cake and Lucerne Hay for Cattle: A Report on Digestion Trials Conducted at the University of Pretoria. 62 to 67. *Sultanic Agri. Soc Tech. Sec. Bull. Nos. 2, 4, 5, 7, 8, 9.* Some Aspects of Bacteriological Activity in Egyptian Soils. A Study of Nitrogen and Root Space as Factors Limiting the Yield of Maize in Egypt. The Digestibility of Bersim (Trifolium Alexandrinum). Some Observations on the Growth of Maize in Egypt. Farmyard Manure in Egypt. Moki Lima Beans. 68. An Economic Study of Agriculture in Northern Livingston County, New York. *Cornell Univ. A. E. S. Bull. 539.* 69 & 70. *Oklahoma A. E. S. Bull. 205 & 206.* Easily Soluble Phosphorus in Oklahoma Soils. Soil Fertility and Sweet Clover Production in Oklahoma. 71. Studies on Summer Cover Crops in a Pineapple Orange Grove. *Florida A. E. S. Bull. 253.* 72. Growth and Decline of Farm Trade Centres in Minnesota, 1905-30. *Minnesota A. E. S. Bull. 287.* 73. The Relation of Feather Pigmentation to Intensity of Laying in Rhode Island Reds. *Massachusetts A. E. S. Bull. 288.*

D. Leaflets, Circulars &c.

1. Compost Manure From Farm Waste by the Indore Method. *Indore Inst. Plant Ind. Leaflet No. 1.* 2 to 4. *India Lac. Res. Inst. Res. Note Nos. 1, 2 & 3 June' 32.* A Note on Bleaching Shellac. A Note on Determination of Shellac Fluidity. A Note on the Swelling of Shellac. 5. Production and Trade on the British West Indies, British Guiana, Bermuda & British Honduras. *E. M. B./T. P. 24.* 6 to 9. *Min. Agri. Fish. Adv. Leaf. 151 to 154.* The Cultivation of Parsnips. The Culture of Green Peas and Beans. Mange in Cattle. Fruit Tree Capsids. 10. The Dorsett, Fairfax, and Narcissa Strawberries. *U. S. A. Dept. Agri. Cir. 257.*

E. Reprints.

1. List Showing the Available Publications of the Agricultural Department, Madras. 2. World Rice Situation, U. S. Dept. Agriculture Bureau of Agricultural Economics.

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The Ramasastrulu–Munagala Prize, 1933.

1. The prize will be awarded in July 1933. 2. The prize will be in the form of a Medal and will be awarded to the member of the Union who submits the best account of original research or enquiry, carried out by him on any agricultural subject. 3. The subject matter shall not exceed in length twelve foolscap pages type-written on one side. 4. Intending competitors should notify the Secretary of the Madras Agricultural Students' Union not later than the 15th May the subject of the paper which they propose to submit and the paper should be sent in so as to reach the Secretary, Madras Agricultural Students' Union not later than the 1st June 1933, with a covering letter showing full name and address of the sender. The author's name should not be shown on the paper but should be entered under a nom de plume. 5. Four type-written copies of the essay should be sent in. 6. The name of the successful competitor will be announced and the prize awarded at the time of the Conference. 7. Papers submitted will become the property of the Union and the Union reserves to itself the right of publishing all or any of the papers. 8. All references in the paper to published books, reports or papers by other workers must be acknowledged. 9. Any further particulars may be obtained from the Secretary, Madras Agricultural Students' Union, Lawley Road, P. O., Coimbatore.

evolve two high yielding strains one in each of the two important varieties of Kistna and Guntur Districts. That this was possible was due to the willing co-operation of the Deputy Director of Agriculture, II Circle, and some of the enthusiastic land-lords who very willingly made their lands available for the actual testing of the selections made at the Maruteru Station.

The isolation of strains, and yield tests with them, both on the station and in ryots' fields, have been going on for the last seven years, with the result that there are now available for release from the station, eight strains. Short notes about each of these strains, the varieties they belong to, their special characteristics, and the tracts and conditions for which they are suitable are given separately.

These notes are expected to be helpful to the ryots in choosing the particular strain most suited to their conditions. The percentage increases of the strains mentioned in the notes indicate their values under average normal conditions of soil and season. It need not be emphasised that the maintaining or increasing the ascertained merits of the strains rests entirely with the cultivators who grow them. First, the worth of the strains can be maintained by adopting all necessary precautions against their getting mixed up with other varieties. Secondly, experiments with the strains on the station have proved that it is possible to enhance the indicated percentage of increases by over 50 per cent. if the fields grown with these strains are suitably fertilised, i. e., the ryot gets his maximum return for any outlay in manuring, by the growing of the strains in preference to local seed.

Bontha Akkullu. Maruteru No. 1 (Mtu. 1) This is a strain of *Akkullu*, a variety grown over forty to fifty per cent. of the area in the Godavary delta and portions of the Kistna delta as well, under a variety of conditions, from the precarious uplands to the saline and submergible coastal areas. The variety is also slowly making its way in the Guntur district. This strain has been under trial on the station for six years under a variety of conditions and has recorded an average increase of 20 per cent. over ryots' seed. Two year's trials at a number of centres in the district have established definitely its superiority and its cosmopolitan nature. The grain yield varied between 2800 to 3700 lb. per acre, depending upon the season, fertility of the land, manure applied and time of planting Its normal flowering time is the third week of October, irrespective of the time of sowing or planting, with broad limits. The rice is white.

Potti Akkullu. Maruteru No. 2 (Mtu. 2). This is another strain of *Akkullu* with rather slower initial growth found suitable to rich lands that usually suffer from rank growth and premature lodging. During six years' trial it has recorded an average increase of 16 per cent over the local seed. It normally flowers during the third week of

October, slightly later than Mtu. 1.—(*Bontha Akkullu*). The grain yield obtained on the station ranged between 2800 to 3500 lb. per acre, according to the time of planting, and the fertility of the plot. The rice is white.

Potti Basangi Maruteru No. 3 (Mtu. 3), This is a bulk made up of five of the high yielding strains in *Basangi* which is also known as *Rasangi* in the East Godavary District. The cultivation of *Basangi* and *Rasangi* is confined to about ten per cent. of the area, particularly in the higher portions of the delta. *Basangi* though generally a higher yielder than the other medium and late varieties of the tract, its area is restricted, due to the fact that its harvest invariably synchronises with the north-east monsoon rains. The average increase of the strains making up the bulk was 12 per cent. over the ryots' seed during the four-year period of trial on the station. The acre yield of *Potti Basangi* varied between 3500 to 4500 lb. depending upon the time of planting and the fertility of the plot. It is also reported by ryots who have grown this during the two previous years, that it gave between 25—28 bags of paddy per acre in rich and early planted fields, against the maximum yield of 22 bags obtained previously. Apart from its potentiality for high yields, another redeeming feature of *Potti Basangi*, as the name would indicate, is its short slow-growing habit in the initial stages which helps the crop to get over the lodging trouble, invariably experienced with the *Basangi* crop in wet harvest seasons. It flowers generally during the fourth week of September. Its rice is white and the grain is short and plump compared to the local seed. *Potti Basangi* is particularly suitable to areas where planting can be done early, but not suitable to areas of poor fertility and where planting is done late.

Pedha Basangi, Maruteru No. 4 (Mtu. 4). This is another selected bulk composed of 2 strains. It is later in duration than *Potti Basangi* by a week. It has been found useful to areas of average fertility planted late. The bulk has recorded, an average increased yield of 9 per cent. over the local seed during 4 year's trials. The yield varied between 3200 to 3800 lb. per acre. The rice is white and the grain size is narrower than the local seed. Further *Pedha Basangi* has been noted to stand indifferent water supply during its vegetative growth and has recorded an acre yield of 3000 to 3300 lb. per acre under such conditions.

Bontha Krishnakatukkulu, Maruteru No. 5 (Mtu. 5). This is a selected bulk comprising two high yielding strains of *Krishnakatukullu*. This is a popular variety of the West Godavary district covering 30—40 per cent of the area in the Western delta, and due to the fineness of grain always fetches better prices. The two strains composing the bulk maintained an average increased yield of 10—12 per cent. over the ryots' bulk during the past six years of the trial. The flowering time is towards the last week in October. It has the desirable growth habit to get over lodging under conditions where a crop from ryots, bulk invariably lodges. *Krishnakatukullu* as a variety is susceptible to unsetting if rainy weather synchronises with its flowering period. On that account the grain yield is liable to fluctuate from season to season. On the station under ordinary conditions of cultivation, it has produced acre yields of 2800—3400 lb.

Potti Atragada. Maruteru No. 6 (Mtu. 6). This is a strain in variety *Atragada* of the Godavary delta which is cultivated in about 5 per cent. of the area confined mostly to the lower reaches, where water does not drain off early for harvest. It has given an average increase of 16 per cent over the ryots, bulk tested over a period of four years. The crop grown in the district for observation has impressed the grower, of its superiorty. The grain yield varies between 2800 to 3000 lb. per acre. It flowers during the end of October and is quite different from both the *Pedha* and *Sanna Atragadas* of the Kistna district which flower between the 10th and 15th of November.

Gutti Kusuma. Maruteru No. 7 (Mtu 7). This is a selected bulk composed of a few promising strains in *Gutti Kusuma*, a variety grown over 40—50 per cent. of the area in Kistna and Guntur deltas. This selected bulk was tested for three seasons in the district itself in ryots' lands and has given a consistent average increase of 16 per cent. at a number of centres. The grain yield varied between 3400 to 3700 lb. per acre in two of the trial plots as compared to 2700 to 3200 lb. obtained from ryot's seed. It flowers during the second week in November, later than the local Kusuma by about a week and it is not subject to the lodging trouble. It gives bold, well-filled, good, white rice.

Vanki Sannam. Maruteru No. 8 (Mtu 8). This is a strain in *Vankisannam*, also known as Delhi *Boghum*. The variety is cultivated in about 15—20 per cent of the area in the Kistna and Guntur deltas, specially confined to the higher delta and well drained soils. The strain has been under test in the district for three consecutive seasons and has recorded an average increase of 10 per cent. over the local seed. An increase of over 18—20 per cent. has also been obtained in plots that escaped damage by rains during the flowering period. The maximum grain yield obtained in one of the trial plots at *Duggirala* was 3400 lb. per acre. It flowers during the end of first week in November, three to four days earlier than the ryots' seed. *Vankisannam*, as a variety, is defective in unsetting and shedding qualities, but this strain is noticed to be comparatively free from these defects. The crop raised from the strain has a characteristic dark green appearance during the early vegetative growth and an erect flag leaf during the flowering and ripening stages.

SOME PROPHYLACTIC MEASURES IN INSECT PEST CONTROL

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The well-known saying that " Prevention is better than cure " is a very old maxim and is specially appropriate, in many cases, where we have to deal with diseases and pests of various kinds; but, unfortunately the very sage advice contained in the pithy saying, is more honoured in its breach, than in its observance. It may be affirmed that in the case of many insect pests, prophylactic measures will be found far more practicable and economical, than those adopted to actually fight a disease or pest when it has made its appearance, and when it often becomes too late to employ preventive measures or, too difficult to resort to curative methods. In certain special cases, no other methods other than preventives will be found practicable. The more important preventive methods against crop pests, may be conveniently grouped under one of two kinds, viz., cultural and sanitary. The following is a brief summary of some of the more practicable and advantageous preventive methods which can be adopted against insect pests under South Indian conditions.

I. **Field And Plant Sanitation.** (1) *Keeping the fields clean by regular removal of all weeds* is important, since many crop insects feed on some weeds when their cultivated food plant is not available. Examples of such insects are—the Paddy mealy bug, the Rice bug, the Army worm, the Sunnhemp moth, the Fruit moth, etc., (2) *Pruning of dead branches, removal of loose bark, scraping of the unhealthy stems* and *patching up wounds with clay and tar* in fruit and other trees of economic importance; these measures will kill some insects which lurk or hibernate in these situations in one of their many stages, and which would otherwise attack the healthy parts of the plants in due course. Examples are shoot, bark and stem boring beetles, bark caterpillars, etc. The removal of the dead and splitting of crownless rotting palm trees and drying the stems will keep away the palm weevil and the rhinoceros beetle in coconut gardens. (3) *The removal of all remains of a crop* after harvest such as stubbles of cereals like paddy and cholam, old cotton, brinjal, sweet potato and cucurbitaceous plants. Failure to remove these, allows borers, etc., to breed unnoticed and appear on the crops during the following season, (4) *Proper disposal of litter*—in cattle sheds and stables. The trouble from domestic and cattle flies can be prevented by proper disposal of cattle yard and stable manure in which flies of all sorts breed, multiply and become not only a nuisance, but also play their part as disease-carriers in some cases. The oiling of stagnant pools and ponds to destroy mosquito larvae, is a similar measure. Under this heading may also be brought the periodical raking up of the manure heaps, to prevent multiplication of the rhinoceros beetle grubs, and other cockchafer larvae that breed in them.

II. Cultural Methods. Some of these methods though partially curative, go a great way in checking the multiplication of some pests and effecting their control very easily and economically. (1) *Deep ploughing in general.* To destroy weeds, white grubs attacking garden crops like chillies, groundnut, etc., pupae of hairy and Sphingid caterpillars often attacking crops like groundnut, green gram, sweet potato and gingelly, this method will be found very helpful. (2) *Ploughing and raking up of field bunds* for destroying grasshopper eggs in paddy areas like Malabar, Ganjam, etc., forms another preventive measure in such areas. (3) *Crop rotation.* It is perhaps not widely realised that apart from its agricultural benefits, this method of growing crops in rotation on any area is also beneficial in checking the multiplication of some insect pests which would otherwise continue breeding in the same area right through the year. (4) *Digging out and destroying ants' nests in fields*—white ant attack on wheat, groundnut and cane and the occasional outbreaks of red ants on brinjal and other garden plants, can be prevented by this prophylactic measure. (5) *Raking up and hoeing of the soil* around melon plants and around mango and other fruit trees like Guava, Zizyphus, etc., which suffer from attacks of fruit flies, will destroy the underground pupae of these flies and prevent further breeding; this may be done for plants suffering from flea beetle and leaf beetle attacks also—such as the Pollu flea beetle in pepper areas, the pumpkin and other leaf beetles and the beetle pests of grape vine. (6) *Thorough drying before storage.* The thorough drying and chaff-free-storing of harvested crops like grains, pulses, oil seeds, ginger, turmeric, nuts of different kinds, pepper, cardamoms, chillies, etc., will prevent the infestation and multiplication of many insect pests like weevils, moths, mites, etc., which are partial to such stored products. It has also to be remembered that there is no good of storing such clean and healthy seeds in pest-infested and unclean cellars and vessels. Small quantities of valuable seeds may also be preserved in jars with a layer of sand on the top surface; this is found to prevent weevil-breeding in many cases. The use of naphthalene to keep away vermin from stored products, records, pictures, etc., is another closely allied method. A further precaution in this direction is to fumigate the commodities and store them in insect-proof vessels. Fumigation of ordinary seeds, etc., can be done by the use of carbon-bi-sulphide, which, of course, has to be done by trained hands. (7) *Flooding.* Whenever possible flooding may be resorted to, to check the multiplication of cut-worms, mole crickets, white grubs, and other underground pests often found in garden areas.

III. Other Preventive Measures. (1) *Treatment of cane setts before planting.* Before planting sugarcane and grape-wine, setts may be treated with Copper sulphate, dilute Crude oil emulsion, or tar water to prevent white ant, mealy bugs and even borers. (2) *Light Traps*—Many insects including some well-known crop pests are attracted to lights; the setting up of light traps at the very beginning of a season when a phototropic insect pest is likely to appear, will nip the pest in the bud and very greatly check its multiplication and reduce its menace as a serious pest. Such are the paddy stem borer, the groundnut *surul*, the hairy caterpillar moths, the cockchafer beetles, one or two of the sorghum and cane borers, the ragi white borer, the spotted jassid of paddy, and many others. A study of the light trap catches in any area for a fairly long period, will give any one an idea of the incidence of the phototropic insects and the time of the year when they usually appear. Even bon-fires in field bunds at such seasons will serve the purpose. (3) *Covering ripening fruits to prevent insect attack.* Pomegranate fruits of good quality and size are kept free from the borer butterfly, by loose muslin or paper covers which prevent the butterfly from laying eggs on the fruit. Batavian and allied varieties of oranges, are often covered with cheap bamboo baskets in parts of the Northern Circars. Though the practice originated with a different purpose, it prevents the attack of the fruit-sucking moth which is a bad pest in the area. (4) *Banding cocoanut trees with smooth tin plates* will prevent rats going up the trees and causing damage to the nuts. A similar measure is the tarring of the stems of fruit and other trees to prevent white ant infestation. (5) *Use of healthy seeds, cuttings, tubers, etc., for propagation.* This is particularly the case with seed potatoes which often contain the borer larvae, cane setts often containing mealy bugs, borers and white ants, cuttings of grape-vine, crotons and other garden plants containing scales and mealy bugs. etc.

The above are some of the more suggestive and practical methods of actually preventing outbreaks of insect pests in many cases, and in some, to considerably minimise the damage even when the pest appears. The success of many such preventive measures depends a good deal, on the promptness with which they are adopted for different pests. It may also be added, that for an effective and economic application of one or more of the above prophylactic measures for different insect pests, it is essential that one should have correct ideas of the insect or insects, and the approximate seasons in the year when the different forms begin to appear in his tract. This is easily gained by intelligent preliminary observations, and records made through different seasons for a year or two, and then compiling a sort of pest calendar for the tract. There is no doubt that as the farmer gets to know his important pests and their vagaries, he will himself be able to devise such prophylactic measures which might suit specific pests and special localities.

DRY FARMING WITH SPECIAL REFERENCE TO PUDUKOTTAI STATE.

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Dry farming as at present understood is the system of farming extensive areas of land purely with the aid of rainfall received in a locality. It mainly consists in the attempt to save all the rainfall of one or more seasons, by different agricultural operations for the use of a crop during its period of growth. In foreign countries where rainfall in some places is not more than 12 inches annually, fair crops have thus been realised by cropping the land every other year.

Under this system great care is taken to keep the land stirred often, even when there is no crop in the field, the objects being, to maintain the soil in good tilth, to make it ever ready to absorb the rain, dew, etc. to the largest extent possible, and at the same time to prevent the evaporation of soil moisture due to atmospheric changes. This method of cultivation in western countries is termed cultivated fallow i. e., laying lands fallow but in a stirred state.

The production of one or more crops without irrigation, in places with 20 inches or less rain, and the cropping in places with an uneven distribution of rainfall, annually amounting to about 30 inches, are considered by some to come under dry farming. The cultivation of *Varagu*, (*Paspalum scrobiculatum*) groundnut, *Cumbu* (*Pennisetum typhoideum*) pure or mixed with red gram, *Ragi*, (*Eleusine corocana*) castor, lablab and sorghum as carried on in the major portion of the Pudukottai State, come under this category. Dry farming also embraces the apportionment of vast areas into suitable blocks, for pastures, or for raising fodder crops and the rearing of live-stock.

For successful dry farming, a clear knowledge of the local conditions i. e., the soil and rainfall, is necessary. A study of the rainfall statistics for Pudukottah, as given below will clearly show that there is no constancy in the amount of rainfall in any month, and the wide variations between years often disappoint the ryots in the pursuit of any definite cropping.

Rainfall at the Pudukottai station from 1921—22 to 1930.

Years.	Total.	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.
1921—22	30·41	6·37	4·29	5 13	5·10	0·42	3·55	0·22	...	...	0·74	3·09	1·10
1922—23.	45·09	1·46	3·91	7·78	5·66	7·88	2·39	10·86	0·18	3 84	...	0·57	0·56
1923—24.	42·46	1·08	0·89	9·54	12·39	0.06	7·58	1·68	...	1·31	0·76	4·60	2·57
1924—25.	35·69	4·72	6·05	5·38	4·06	2·80	1·23	0·69	0·02	2·33	0·32	5·29	2·82
1925—26.	35·53	1·37	5·79	2·28	3·85	10·64	3·24	4·54	0·37	0·27	0·77	0·34	2·07
1926—27.	38·55	0·78	7·08	7·30	7·75	2·39	0·70	1·07	1·78	1·24	2·11	2·87	3·47
1927—28.	26·99	0·27	1·78	3·85	3·57	5·66	1·73	0·75	0·30	0·30	3·28	3·27	...
1928—29.	30·01	4·27	1·01	4·20	3 69	6·33	4·29	0·96	0·11	...	0·95	1·52	2·68
1929—30.	40·47	1·94	2·33	8·77	5·01	5·60	4·72	1·09	0·88	0·41	...	8·40	1·32
1930—31.	49·13	0·96	1·32	3·41	27·82	4·64	1·08	1·01	...	0·02	2·21	3·61	3·55

Total. 374·33 – Annual average 37·43.

It will be seen from the above table that the annual average has increased to 37·43 due to the unusually heavy and sudden precipitations in certain months during the last two years; but the State average works out to 34″ per annum for the same decade. Though the average rain-fall received is about 34″, due to the peculiar climate and the nature of the soil, 70% of the lands under plough, come under typical dry-farming areas. The major portion of the soil is gravelly ferruginous red loam, full of sand-stones and intercepted here and there with black clayey soil of saline character. The surface is more or less flat, interposed with a few hillocks and rocks. The sun between April and June is unbearably hot and many wells fail to supply water during this period. The climate is usually hot and dry, and the maximum temperature in the summer months rises above 102°F for several days.

"The vagaries of the monsoon" are rather a rule than an exception to this State. Practically an extent of three lakhs of acres out of five lakhs of arable area comes under dry cultivation. The insufficient rainfall during the season (April—June) and the subsequent drought or heavy rains, adversely affect the yield of the dry crops. This freak of the monsoons during the sowing season and afterwards, compels the dry land farmer to be prompt and efficient in his farm operations to ensure a successful harvest.

Principles of dry farming. The principles which underlie dry cultivation are (1) conservation of soil moisture and regulation of its movement in the soil, (2) maintenance of soil fertility, (3) raising of crops suitable to local conditions i. e. with reference to the quantity of moisture available in the soil and the requirements of the crop.

Control of soil moisture. Water is the most important factor in crop production in dry-farming areas. Without moisture in the soil, no crop can be grown anywhere and much less in dry-farming areas. This compels a dry land ryot to pay particular attention to ploughing and preparing the soil to such a tilth as to secure the required amount of moisture. He should therefore see that the maximum amount of water during the rains is absorbed and is preserved in the soil. It is also necessary that the surface soil, thus reduced to a fit condition, is not also washed out by heavy rains or surface drainage. To achieve the objects mentioned above, we should be quite conversant with the several farm operations and their influence on soil water and soil fertility.

Preparation of land and utilisation of soil water. Tillage of the soil is of great importance as a means of absorbing and retaining moisture as much as possible, from the natural sources, for use during the months when the crop-demands are great. The deeper the soil is ploughed and the finer the soil particles rendered, the greater is the depth of loose soil available for retaining large quantity of water for the use of a crop, the surplus also gradually sinking into the layers below. The shallow depth to which the wooden country plough penetrates, tends to make rain water get into that portion quickly, but the hard layer below does not as quickly absorb it, so that the top ploughed layer becomes slushy and when more rain is received the fertile portion in the surface is sometimes washed off exposing an unfertile layer. Thus a deep and thorough ploughing is essential to prevent surface wash. It should be repeated at least once in three years for successful farming.

Again, the water holding capacity of the soil is increased by raising the quantity of humus in the soil. This decayed organic matter really gives life to the soil and is greatly needed by the soils in this State. It fills up vacant spaces between particles of sandy soil and helps it to hold more moisture. Again, when applied to clayey soils it absorbs rain water quicker and holds it longer in dry weather. It regulates soil aeration, favours root development and hastens the activities of the microorganisms in the soil. Frequent inter-cultivation between crops especially after every rain tends to arrest the growth of weeds and also minimises the loss of moisture and ultimately helps in reaping a better harvest. Even long periods of drought can be tided over, if the cultivators frequently keep the surface soil loose and open, to absorb the available moisture readily. Ryots here, are yet lacking in realising the value of inter-cultivation and of the timely removal of weeds, which as a result of neglect rob the crop of the moisture and the plant food which would otherwise be available for it. These methods are best carried out if the crops are drilled i. e., sown in lines. While big implements and machinery are largely used in farming by the peasants of other countries, our farmers have not reached even a stage when they could use the inter-cultivating implements which need only bullock power. Drill-sowing reduces the seed rate and facilitates the deposition of seeds at required depths to aid uniform growth. Besides, it tends to complete the cultural operations, before the surface soil loses its moisture. The constant stirring of the soil with the bullock hoes between the rows of the crop, enables the farmer to regulate the moisture needs, and thereby get a better crop than under broad cast sowing, when it is not so easy to weed frequently and stir the soil loose with manual labour as often as weather conditions require. It is therefore, necessary that our ryots should change their present methods of sowing and take to drills, bullock hoes, etc. so that they may reduce the cost of production and farm a greater area with less labour. If some careful and enthusiastic ryots are encouraged to follow new methods by awards of prizes or other inducements, such improvement will be quickly taken up by other ryots also and become established in the tract.

The next point to be considered is the maintenance of soil fertility. The continuous renewal of crops year after year from the soil and the constant tillage operations go to exhaust the plant food in the soil and largely the humus (organic matter). The loss of soil fertility (crop producing power) occurring in nature is so gradual that the depletion of fertility is not realised until the soil begins to give very poor returns. In this State, the *Odayars* are as a rule better cultivators than other classes, and they have realised the value of maintaining the fertility of the soil by manuring. Sheep or cattle may be penned. Judicious quantities of cattle manure or sweepings may be applied. These methods surely increase the organic matter in the soil. Lost fertility can be made good by giving the land temporary rest for some time, when natural agencies bring about decay of organic matter and 'cook' the soil, for later crop production.

By adopting rotation in cropping, the natural productive power of the soil can be also maintained. Rotation means the growing of a given number of crops of different nature, in a regular order, in the same area, to regulate and control the soil fertility. This is done by a balanced removal of plant foods from the different layers in the soil either by cultivating deep rooted crops and shallow rooted ones alternately, in the same field, or exhaustive crops to follow restorative ones. This system often helps the farmer in protecting the crop from pests and diseases and keeping the soil free from weeds. In addition, it also helps even distribution of labour throughout the year. Rotation is a necessity here, since certain crops refuse to yield well after a few seasons.

Selection of suitable crops for dry lands. A crop generally suitable to the place, the cropping season and the local markets is preferred for cultivation ; a note on the principal dry land crop in the State will not be out of place here. *Varagu* :—This being the main food crop for the dry land ryot of this State it is extensely cultivated, either pure or mixed with *Cumbu* and groundnut. This crop is at present subject to the attacks of a root parasite locally known as *Kudivirattipoondu*, or *Palli poondu*, (*Striga lutea*) which considerably reduces the outturn. Removing this parasite before it flowers and abandoning for some years the cultivation of cereals like *Varagu* and *Cholam* that are susceptible to the attack, are being advised to arrest the spread of this parasite. It will be a boon to ryots of the State if they could get some strains of *Varagu*, resistant to parasites. *Ground nut*:—This is now being cultivated in all classes of lands dry, wet, and garden, and it extends to 17350 acres. Mauritius nut is the popular variety but it is said to have degenerated in quality and out-turn, perhaps, due to its continued cultivation without rotation and proper manuring. More hollow pods are found in the harvest and the ryots are advised to change the seed and apply a basal dressing of lime to remedy this defect. For late seasons they are recommended to grow bunch varieties which are short-duration ones. The ryots are also being enlightened on the benefits of using the *H. M. Guntakka* (a modified blade harrow) for harvest, to reduce the cost of cultivation. *Red Gram*:—This is the next important crop and it is usually mixed with *Cumbu* or *Varagu*, and no change in its cultivation is necessary. If the season happens to be late for this crop, other pulses like black and horse gram are recommended.

There are at present 34,000 acres of cultivable waste lands in this State, of which a major portion is suitable for raising plantations like *Senna*, silkcotton, cashew-nut, casuarina etc. As these crops require attention only in their initial stages, and as they are afterwards adapted to dry conditions, efforts are being made to popularise their cultivation here. When the farmer becomes sufficiently conversant with the soil and the seasonal changes in the locality, he may attempt to raise a better crop and try the change. If he finds the change beneficial he can gradually extend the area under a new crop and even tap fresh markets. To be brief, conservation of rain water, prevention of the loss of soil moisture and fertility, go hand in hand in the development of dry farming.

Conditions requisite for their initiation. Though a greater portion of dry fields in this State is not level, but undulating, our ryots carry on cultivation without effecting improvements. While the plants in the elevated portions may suffer for want of moisture those in the lower levels are water-logged and the entire crop consequently results in a poor return. Such defects can be rectified during the slack seasons and fields rendered as level as possible consistent with the drainage. The steep and sloping lands may be divided into small plots under terrace system and the plots suitably bunded and provided with turf vents to prevent erosion. In this State the number of actual cultivators is small in many villages, and of these many have emigrated to obtain a living elsewhere. Those who still cling to their homes, are heavily indebted. Many owners of lands do not live in villages and do not care to consolidate these holdings to the desired extent or adopt improvements. If some enterprising capitalists would reside in villages and demonstrate dry land farming on scientific lines our peasants will follow them. Where extensive areas are available, cultivators and colonists from outside may be attracted to such lands by offering inducements.

THE POULTRY INDUSTRY OF INDIA

BY R. L. PANDEY,

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Part I.

India is supposed to be the original home of poultry and it is presumed that the genus *Gallus* originally migrated from India to other parts of the world, although it is difficult at the present time to trace this migration in all its stages, through the passing of time. In Indian literature, ancient, medieval and modern, references also abound, mentioning the superior qualities of poultry-flesh and its aphrodisiac, health-promoting and disease-eradicating properties Proverbs and pithy sayings about what human beings might learn from the life of poultry, as among other animals and birds, are to be found in the writings of Chanakya a great Hindu politician and naturalist who lived about 400 B. C.

While these references unmistakably point out to the flourishing condition of the poultry industry in the ancient days, we have it on record historically, how, during the Mohamadan period, the industry got a fillip on account of the great interest taken by the court, where cock fighting happened to be one of the chief amusements. The interest evinced by the rulers of the land is reflected even in the writings of the Urdu authors of the times, wherefrom it is clear that there was a popular belief, that the cock and its flesh were even supposed to posses mysterious powers. How far this superstitious belief was rooted in the popular mind could be gauged from the fact, that an idea was prevalent, that once in its life time, the cock laid a very small egg called in Arabic " Bayzat-i-vgr ".

But the industry could not reach a high standard of development on account of religious considerations in the case of Hindus and the decline in power in the case of Mohamadans.

Present condition of the industry. At present the industry is in the hands of ignorant men. There is no system of breeding, feeding, housing etc. Fowls inbreed as they please and are bred just to supply eggs and table birds without any attention to size. These birds have to look for food themselves. If the master is kind a handful of grain is all they can expect from him but in the majority of cases that too is missing. Under these conditions their vitality has detriorated and the birds have become susceptible to many diseases. Often, whole flocks are wiped out on account of plague, cholera, ticks, fever, etc. Still, taking into consideration the circumstances under which it has to live, the indigenous fowl is a hardy bird and is capable of enduring very adverse circumstances, but, on account of the treatment meted out to it, the size and the laying have deteriorated considerably.

Species of Fowls found in India. The red jungle fowl is found in abundance in the jungles of Northern India, with different kinds of pheasants, while the grey jungle fowl, *Gallus Sonnaratti*, is found in the Southern India jungles. Domestic fowls that are prevalent in India at present can be put under the following heads:—

(1) Those that resemble the jungle fowl; they seldom exceed 3 to 3½ lb. in weight and are very poor egg producers both in size and number. (2) *Aseels*, the pure-bred game-fowl ; this breed is getting

very rare and is found in the hands of a few breeders. (a) *Ghages*—resembling *Aseels* are slow maturing good table birds, but very poor layers. (b) *Chittagongs*—so called after the name of that district of Bengal. This is a valuable breed both as regards laying as well as table qualities. (c) *Karaknath*—The eyes, skin and blood of this breed are all black. This breed is getting extinct. (3) Modern Breeds:—(a) In this class will be the modern breeds of Europe and America such as *Rhode Island Reds*, *Leghorns*, *Minorcas etc.* (b) The crosses between (a) above and the country fowls. They are bigger in size and are better layers. (c) In addition to the classes enumerated above there are a number of geese, ducks, turkeys, guinea fowls and various kinds of pheasants.

Among the modern breeds, White Leghorns, Black Minorcas, Rhode Island Reds, Orpingtons are very popular and seem to stand the climate well.

Organisation. Unfortunately the Central Government has till now done nothing to promote the industry of poultry farming but of late some of the Provincial Governments have been taking some interest in the industry.

The chief agencies for the promotion of this industry in India at present are as under;— 1. *The U. P. Poultry Association, Lucknow.* This is the most important and the pioneer organisation in the whole of India. 2. *Poultry Sections of the Agricultural Department of the Punjab, Bengal, Bombay and Madras.* These sections have been started very recently on a small scale. 3. *Indian Poultry Clubs.* (i) South Indian Poultry Club. (ii) Bombay Presidency Poultry Club. (iii) Burma Poultry Club. 4. *Christian Missions.* American Mission in Etah. U. P., Katpadi and Ramanathapuram in Madras Presidency and Hubli in Bombay Presidency. 5. There is a small poultry section connected with Dr. Rabindranath Tagore's (the world famous poet) rural reconstruction work in Bengal. Among the Indian States, Kashmir, Baroda, Hyderabad and some smaller states have started small poultry sections which are connected with their Agricultural Departments.

As no records have ever been kept of the number of head of poultry in India, it is impossible to give any accurate data on the point, but it is roughly calculated that out of 350 millions of people about ⅙th of the population participate in this cottage industry, each family keeping about 6 to 7 birds.

Methods of Marketing. The marketing of eggs and fowls is in the hands of the professional dealers, who make house to house collection and transport the produce to market towns. The eggs are sold by number and not by weight. Generally eggs are packed in a sort of earthern jar and an egg-shell is tied on the top of it, which denotes the delicacy of the contents and warns the people to handle them carefully.

The Railways charge half the usual parcel-rates for egg-parcels, but their charges for empties and live poultry are very high and these do not encourge the industry. The average weight of an egg is about 1½ oz. and that of a table-bird generally about 3 to 4 lb. The average production of the country hen is about 40 to 60 eggs. The price for poultry production in the different parts of the country varies from 6 to 12 annas which is equivalant to 6 to 12 pence. There is no standard for eggs or poultry. Larger eggs command slightly higher price. Table birds are sold by piece prices ranging from 8 to 10 d. according to demands and size. The industry is carried on between the peasant-producer on the one hand and the consumer on the other through the agency of the middle man who makes the most of the deal. There is no trade in bye-products of poultry. They are all wasted.

Obstacles for the Industry. There are several difficulties that come in the way of the development of this useful industry, some of which are noted below:— 1. Most of the people of the country are vegetarians and have got religious scruples, which are up against poultry-farming. 2. The ignorance and poverty of the peasants and their lack of knowledge as to how to handle these living beings are formidable obstacles. 3. The susceptibility of poultry to diseases and different climatic conditions. There are no scientific research institutions where any thought is given to problems relating to poultry. 4. Lack of proper breeding stock in the country. Except the United Provinces Poultry Association, Demonstration Farm at Lucknow, I do not know of any other farm through out the length and breadth of India and Burma, where any pedigree breeding is conducted. 5. There is no organised system of marketing the produce. There is no State Law to govern this factor, there is no check to bringing sick fowls to the markets and there is no restriction to selling stale eggs in the open market. Even the purchasers do not take proper measures to ensure that they are getting proper quality commodity for the money spent.

Part II

POULTRY BREEDING IN THE UNITED PROVINCES

For the past 22 years some small efforts have been made to effect some improvement in Indian poultry. In 1910 an unofficial body styling themselves as the Indian Poultry Club was formed. The body has been instrumental in interesting the public in modern pure-bred fowls by holding exhibitions in different parts of the country. They also publish a monthly journal "The Indian Poultry Gazette."

As an outcome of this club Sir Hercourt Butler, the late Governor of these Provinces, in 1919 asked his Government to finance a small scheme, which would have as its objects (1) the improvement of poultry in the United Provinces. (2) to popularise the breeding of fowls and (3) to educate the public on the importance of the industry.

Mrs. Fawkes was appointed as Poultry Expert to the United Provinces Government—with her headquarters at Lucknow, which is one of the big cities of India and a very central place in the Province, with a small staff consisting of (1) a Farm Manager. (2) an Assistant Secretary and Demonstrator. and (3) one Office clerk with a small menial staff.

Keeping these points in view, two farms were established, in 1920—21 one in the Horticultural Gardens, Lucknow and the other at the Government Bovine Depot at Patwa Dangar, near Naini Tal. The purpose of these farms was:— (1) to demonstrate how poultry farming should be conducted. (2) to breed such breeds of fowls as would be suitable to the conditions of the country. (3) to provide stock birds and eggs of the improved breeds throughout the whole Province. (4) to study the suitability of poultry foods grown in the country. (5) to study poultry diseases as far as possible, and (6) to evolve a suitable breed of fowl that will combine greater production and immunity from poultry diseases etc.

As regards the popularisation of good breeds of fowls and the educational work, the following methods were adopted:-(1) Instructive and interesting articles were contributed to the important newspapers on the importance of the industry. (2) Lectures were delivered, illustrated by magic lantern slides and later on also by screening a Cinema film, on poultry industry in India, (3) Poultry shows and Demonstrations were organised at all the important Agricultural fairs and other exhibitions that take place every year in these Provinces as well as separately, in which the successful exhibitors were given prizes in cash or stock birds as an encouragement. (4) Pamphlets and bulletins were issued on poultry keeping free of cost. (5) Training of students in poultrying on up-to-date and scientific lines was conducted as far as possible. (6) Local Associations and poultry societies in connection with the Co-operative Department were organised. (7) Practical demonstrations were given by running a Railway Poultry Car, or Miniature Farm on wheels, which is fully equipped with up-to-date appliances etc. and which runs all over the province whenever possible. (8) Recently, a monthly Poultry Journal in Urdu is started in which instructive articles are published on different points of poultry farming such as diseases, housing, feeding etc. (9) People interested in poultry are enlisted as members all over the Province. (10) Mutual business transactions are arranged between the different farmers. In addition to this thousands of advisory letters have been issued and are being issued every day.

The main object of the Association was to improve the conditions of poor professional poultry keepers and to carry out this policy some small farms were started under the Courts of Wards, District Boards, Criminal Tribes Settlements, and in Etah District through Mr. Slater, an American Missionary, who also has been engaged in teaching the poor villagers the benefit of this industry; and, quite a lot of stock birds and eggs were distributed to the deserving people. Under the supervision of Mr. Slater a large number of cockerels was given to be distributed among villagers. The results were really very encouraging where there was technical and reliable supervision, and in other places though the success was not as much as expected still it did help in improving the country breeds by coming in contact with the improved varieties.

Now year by year the farm grew in popularity and the interest aroused in poultry farming spread all over India, and there was a big demand for our stock.

Success Achieved. Before this Association started, there were practically few people who knew the importance of this industry. To-day we find nearly all the Provincial Governments and most of the Indian States have started Poultry breeding operations, and others are contemplating to do so soon under the Development Departments on a permanent basis. All these schemes are being manned by our students on our lines.

The Kashmir Government started four farms last year and all these farms are being managed by our students and every thing is being done on our suggestions.

The Government of the Punjab which started the work under our directions some five years ago. have started four more breeding centres each under a Deputy Director of Agriculture from the very beginning.

We have trained two men of high education for the Government of Baroda State who are now engaged in poultry work of the State.

Since January 1931 the Government of His Exalted Highness the Nizam have started this work on a grand scale and the work is being carried out earnestly and on our lines and directions.

Experimental work. (1) Pure bred stock imported has been kept successfully through the tropical conditions of the plains, and the progeny deteriorated in no way. (2) The production of pedigree stock has been determined and it is proved that they yield 3 times more than country fowls. (3) The crossing of pure-bred poultry with indigenous ones in villages has resulted in producing a progeny much bigger in size with better laying capacity both in quantity and quality than the country fowl, as described elsewhere. In one year a brown Leghorn-desi cross pullet was put in the Egg-laying Test conducted by us, and laid 61 eggs in 64 days. (4) Controlling of poultry diseases by sanitary measures. For example in 1928—29, the best year of the farm, the disease known as "Ranikhet Disease" broke all over India and the cities and towns were simply cleared of poultry and quite a lot of farms were ruined. Crows were dying in thousands. Every day there used to be dozens of crows which were the carriers of this disease dying on the farm. The disease broke out on the farm, which within its limited space and with its proximity to the municipal rubbish dumping grounds stocked a flock of 1300 birds. But prompt measures were taken and only 10 birds died which were at once destroyed. The saliva of these destroyed birds was sent to Muktesar for examination and there it was tested and proved to contain the infective principle of the same disease. (5) Suitability of food stuff for poultry that grow in this country were tested and people were advised accordingly. (6) A suitable breed of fowls was evolved. The breed combines increased egg production both in number and size, and greater immunity from diseases. The peculiarity of this breed is that while in other breeds the birds lay a fewer eggs and the vitality is reduced and they become useless soon, this has a very good longevity; some of them are 5 years old and still they lay quite well and the size of eggs is remarkably good. Both in 1929-30 and 1930-31 the eggs from this breed won first prizes in large white egg class of the All India Poultry Exhibition.

The brief report on one of the shows held in these Provinces in January, 1932, will throw a good light on the success of poultry work in the Provinces.

The Etah Poultry show. "The fifteenth annual Etah poultry show has just been concluded, and marks the high point in poultry-raising in the Etah District. There are two outstanding features, about the show; (1) that it is a villagers' show; and *(2)* that pure-bred fowls of the White Leghorn and Black Minorca breeds make up 95 per cent. of the show.

A total of 2,341 exhibits by 329 exhibitors from 174 villages was represented. These village men spread out over 8 districts.

At no classic show in either England or America are such large classes in Minorcas and White Leghorns to be found as have characterised the Etah Show.

An outstanding feature of the Etah Show was the visit of His Excellency the Governor, Sir Malcolm Hailey. In a brief speech, before the distribution of prizes, His Excellency voiced his appreciation of the show, and the splendid efforts being made through poultry-raising to improve the economic status of the villager, and particularly the low-caste people.

Mr. Pandey of the U. P. Poultry Association, in making the Judge's remarks, drew attention to the need for developing the poultry industry in each and every district of the Provinces, and finding suitable markets for surplus poultry products."

PROBLEMS OF NUTRITION IN INDIA

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Throughout the whole of India the staple article of diet of the masses is a cereal grain of one kind or another—wheat, barley, millet, maize, rice—sometimes a mixture of two or more of them. Most of these grains are eaten whole; these are not subjected to any milling or refining process before use. The outer layers of the grain and embryo, containing valuable dietary constituents, are thus consumed with endosperm. Rice is the single exception to this rule; though within recent years the use of white flour and white bread is spreading in the larger towns and cities. Rice is always subjected to some form of refining process. In country districts, distant from rice mills it is pounded by the villagers in large mortars; a process which removes some, but not all of the external layers. In towns it is milled and polished in the raw state or after par-boiling or curing. As is well known these processes reduce its nutritive value to a greater or a lesser degree. Biological tests in this laboratory have shown that these cereals differ in nutritive value; whole wheat being the most, and whole rice the least, nutritious. The other cereals occupy an intermediate position between these two extremes. All are deficient in certain food essentials—suitable proteins, calcium, sodium, iron, phosphorus and certain vitamins These deficiencies are greatest in whole rice; and as rice is always subjected to refining processes, always washed before cooking, and always consumed after prolonged boiling, this cereal is, generally speaking, of much lower nutritive value than any of the others.

The nutritive value of some of these cereals may, and often does, vary in different localities; amongst rices grown in different parts of India, this variation may be considerable; the same is true of millets. Thus certain millets grown in the south of India have been found to be surprisingly low in vitamin B, an observation which has a bearing on the not infrequent occurrence of beri-beri in millet-eaters resident in endemic areas of this disease. It has been found, too, that groundnuts and split peas (*dhal*) grown in certain localities in South India, are unexpectedly low in this factor. Observations of this kind have led to the suspicion that the nutritive value of certain cereal grains, legumes and nuts, in common use in India, may depend to some extent on conditions of soil, manure and irrigation under which they are grown. A considerable amount of evidence in support of this supposition has been obtained in this laboratory. Thus, it seems certain that rice grown under conditions of natural rainfall or of watering designed to stimulate natural rainfall contains more vitamin B than the same rice when grown in standing water. The former practice is generally followed in the south-west of India where beri-beri is not endemic; the latter in the south-east where it is. Biological tests appear also to indicate that manurial conditions influence the nutritive value of cereal grains; and it seems likely that the almost universal practice of utilising cow-dung for fuel purposes instead of returning it as manure, to the soil, is one that has a bearing on the nutritive value of Indian food crops. Thus agricultural practice appears to have a definite relation to problems of nutrition in this country.

The varied conditions of climate, rainfall, irrigation, and soil prevailing throughout the Indian Peninsula makes some part of it more suited to the cultivation of one cereal than of another. The cereal or cereals grown in any particular locality are those that enter into the dietaries of the inhabitants of that locality. In the north of India—North-west Frontier Provinces, Punjab, Beluchistan and United Provinces—wheat is the principal cereal grown; though some rice, barley, maize or millet are also grown. Generally speaking, the races resident in these areas—Pathans, (Afridis, Waziris, Bajauris), Punjabis, Sikhs, Baluchis, Rajputs and Paharis—are wheat eaters. Wheat is the staple article of their dietaries; the other cereals mentioned being merely adjuncts to it. A large amount of wheat is also grown in parts of Central India, Bombay and the Deccan; but in general the races resident in these localities such as the Mahrattas, use a diet of mixed cereals—usually wheat and rice. Towards the East, through Bihar to the Coast of Bengal all down the east and west coasts and throughout the Madras Presidency rice is the principal cereal grown; though in parts of these regions millet is also a considerable crop. But, for the most part, the races resident in these areas are rice-eaters. Throughout the rest of India millet is the chief crop, that forms the staple article of diet of races—such as, the Kanarese—resident therein, who commonly use rice as a supplement to it. In parts of Travancore the staple article of diet is the tapioca root supplemented with rice.

As we pass from the north to the east, south-east, south west and south of India there is thus a gradual fall in the nutritive value of food grains forming the staples of the national diets, this fall reaching its lowest limit among the rice eaters of the east and south. There is also a gradual fall in the amount of animal protein, animal fats and vitamins entering into these diets. The races of the north are either milk users or meat eaters or both; while those of the south and east use both meat and milk sparingly and sometimes not at all. Thus the Pathans are meat eaters; the flesh and fat of goats and sheep forming a principal constituent of their dietaries. They also use milk freely, chiefly in the form of butter-milk, curds and butter and ghee. The Sikhs are large users of milk and the products of milk; milk being only an occasional addition to their diet. The Mahrattas also make free use of milk and milk-products. an additional source of animal protein being eggs and fish. The Bengalis, Kanarese and Madrasis, on the other hand, are for the most part vegetarians; and although some of them do eat mutton or fish, millions do not, while milk and milk products are, in general, less extensively used by them than by northern races. It so happens therefore, that as the nutritive values of cereal grains diminish there is also a dimunition in the amount of animal protein ingested and in the level of protein metabolism attained by the races concerned. There is, too, a precipitate fall in the amounts of vitamins A and B ingested by the races of the south as compared with those of the north. Legumes (*dhal*), vegetables and fruit enter into all the national dietaries of India; but it is only among the better classes that a sufficiency of these is eaten. Accompanying the gradual fall in the nutritive values of the national diets there is a gradual decline in the stature, body weight, stamina and efficiency of the people. McCay was the first to draw pointed attention to this association, which my own observations have confirmed. In his book— "The Protein Element in Nutrition" (1912)—he emphasizes the "all important influence exerted by food, and particularly protein in determining the degree of muscular development, the general physical endowment, the power of endurance and resistance to disease, and the most important of all, the place a tribe or race has won for itself in manliness, courage and soldierly instincts." Indeed, nothing could be more striking than the contrast between the manly, stalwart and resolute races of the north—the Pathans, Baluchis, Sikhs, Punjabis, Rajputs and Maharattas—and the poorly developed toneless and supine peoples of the east and south; Bengalis, Madrasis, Kanarese and Travancorians. McCay's work was done before the days of vitamins; and while he rightly emphazized the important part played by the protein element of food in bringing about this result, we now know that other factors—vitamin and mineral elements—are concerned in it also. Inherited factors, climate, customs, caste, religion and endemic diseases no doubt contribute their share to the production of this result; but food is the paramount factor concerned. This is shown to be so by an experiment carried out some years ago (1926) in this laboratory. Groups of youug rats—20 in each—were fed on certain national diets of India; care being taken to stimulate in every detail the culinary practices of the races concerned. The animals were obtained from the same stock, an unusually healthy one. The experiment was so conducted that factors such as climate, atmospheric temperature, rainfall, age, body weight, sex distribution, caging, housing and hygiene were the same in all groups. It was found that the nutritive values of these diets—as determined by the average body weight of each group at the conclusion of the experiment—ranged themselves in the following order:—

Diet.		Average Body-weight of group.
Sikh.	...	235 grams.
Pathan,	...	230 „
Maharatta.	...	225 „
Kanarese.	...	185 „
Bengali	...	180 „
Madrassi	...	155 „

The "Sikh Diet"—the most nutritious of those examined—was made up of freshly ground whole wheat made into cakes of unleavened bread (*Chapatis*), milk, and the products of milk—butter, ghee, curds, butter milk—*dhal* (legume), vegetables (fresh carrots and cabbage) tomatoes, root vegetables, fresh meat with bone and fat once a week and water. The "Madrassi diet"—the least nutritious of those examined—was made up of washed polished rice, *dhal*, (legume) fresh vegetables, condiments, vegetable oil, coffee with sugar and a little milk, a little butter milk, ghee (sparingly), coconut, betel nut and water. The respects in which these two diets differ are obvious.

Further evidence of the health-giving properties of the Sikh diet is afforded by the following experience; my stock rats are fed on this diet. The average daily strength of these is round about 1000; sometimes more, sometimes, less. The animals live under conditions of perfect hygiene and are exposed daily to sun's rays. During the past three years there has been no case of illness amongst them, no death from natural causes (the older animals are killed off when no longer of use for breeding purposes) and no infantile mortality other than an occasional accidental death. Large numbers of them (1189) at all ages upto 2 years, have been killed and subjected to post-mortem examination without revealing any microscopical evidence of disease except an occasional cyst (tapeworm) in the liver Disease has been almost completely excluded by attention to three things; cleanliness, comfort and food These experiences illustrate the great importance of food in relation to the physical efficiency and well being of animals and man; the importance also of a proper balance of the national diets of India with respect to animal protein, animal fat, vitamins and mineral elements; and the great value, as a health promoting agency, of the lacto-vegetarian diet used by the people of North India amongst whom are some of the finest physical specimens of mankind.

Our first problem of nutrition in India—"What diet is most likely to maintain physical efficiency and health?" has thus been solved. It is a diet composed of any whole cereal grain or a mixture of cereal grains, milk, the products of milk—butter, curds and butter milk—legumes, green leafy vegetables, root vegetables fruit and water with meat occasionally. I notice that "Oslo Breakfast"* which is reputed to be having such remarkable beneficial effects in Norwegian children is of this order. To the tribes of our Indian frontier this is " an old accustomed feast".

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* A breakfast served free to School Children and consisting of half a litre of milk, wholemeal bread with butter, wholemeal rusks, a raw carrot, an apple or orange and whey cheese.—Ed.

One further fact in regard to the national diet of India is here deserving of note—it introduces another element into the complexities surrounding problems of nutrition in this country—that of high atmospheric temperature and drought. It was observed in this laboratory, about 10 years ago, that the milk of cows subsisting on the parched pasture available during the hot months of the year contained less vitamin A than that of cows feeding on the green pasture that spring up after the rains. Generally speaking it is safe to say that the vitamin A content of the milk of the ill fed and of ten semi-starved Indian cow is relatively low; a circumstance which is not withoutits effect on the well being of the people into whose dietaries milk and milk products enter.

It is not to be supposed that the national diets of India are invariably used in their completest form by every member of the races concerned. It is only those in better class circumstances who can afford to do so. The poorer classes, according to the degree of their poverty, drop out, in part or in whole, the more expensive or less easily obtainable items; meat, milk, milk-products, animal fats legumes, fruit and vegetables. So that as the people are poorer and poorer their dietaries are more and more cereal in character, more and more unbalanced, more and more depleted of animal protein, animal fats. vitamins and essential mineral elements. Lower down the social scale a stage may be reached when the diet consists mainly of cereals, and lower still it may not provide even enough of these; under nutrition is then added to faulty nutrition—a state in which millions of Indian people exist for the greater part of every year of their lives. "Throughout his daily work the powerful influence of this condition of chronic semi-starvation, not only in the poor Indian himself, but throughout his whole race and generation, is constantly obtruding itself upon the physician, who says, 'This man's constitutional malady is mal-nutrition anaemia, asthenia, complicated with fever, dysentry or what not'. Consequently, the first indication for treatment is a proper and nourishing diet". (Norman Chevers, 1886).

Our next problem of nutrition in India has, therefore, been this "What are the effects, on the people using them. of diets composed of cereals?" This problem may be approached in two ways, and for its proper solution it should be approached in both ways; by an epidemiological survey of diseases with special reference to dietary conditions (an undertaking so great as to be outside the resources of this laboratory) and by animal experimentation. The latter is the way I have followed.

In India we have to deal with combination of food-faults rather than with single food-faults. There is, for instance, no diet in common use in India which while lacking in any single element or complex necessary for normal nutrition, is not at the same time faulty in other regards. It may indeed be doubted whether any deficiency is ever complete; deficiency of vitamin C is the most likely one to be complete. It is with "insufficiency" rather than with complete want of certain food factors that we have to deal: and with a combination of such insufficiencies. Associated with them, there is, as a rule an imbalance of the diet with respect to proximate principles such imbalance usually takes the form of excessive richness of the food in carbohydrates. It is true that one insufficiency or another may be dominant; as for example, an insufficiency of vitamin B in rice eaters. But upon the effects of the dominant insufficiency there are often super-imposed those of other associated insufficiencies, of the imbalance of the food in other regards, or of actual under-nutrition. Our problem in India is not so much of the effects of this or that faulty diet. What then are the effects on the animal organism of a diet composed wholly or almost wholly of rice? What are those of a diet composed wholly or almost wholly of wheat? And to what extent do these effects, as observed in animals, enable us to account for ill-health in man?

To begin with rice. This cereal has many deficiencies prominent among them being that of vitamin B. In India rice is the poorest of all cereals in this complex. The effects of rice on the animal organism, either alone or in combination with other food materials in common use by rice eaters, were studied in the pigeons and monkeys. It was found that the more highly the rice was polished and the more it was washed, the more rapid was the onset of symptoms; and these symptoms were usually of the same kind polyneuritic. But no man lives on rice alone. No matter how great his poverty may be he makes some addition to his rice—a little dhal (legume) a little vegetable or a little of both. These additions raise the nutritive and vitamin B value of the diet to some extent; and it is when animals are kept on a diet of this kind—a diet in which vitamin B is not wholly lacking though insufficient for normal metabolism—that we begin to see signs and symptoms of ill health which are of the greatest importance in relation to the origin of maladies prevailing amongst rice eaters. These signs and symptoms are poor appetite, loss of appetite or (in monkeys) depraved appetite, failure to increase in body weight or actual loss of body weight. vomiting (in monkeys) diarrhoea. dysentery (specific and non-specific), colitis, slowing of the respiratory rate lowering of body temperature, cardio-vascular depression, progressive asthenia, anaemia, disorders of the skin, oedema, nervous irritability, symptoms referable to mal-nutrition of the nervous systems, and intercurrent infections. The last may lend wide variety to the symptomatology; and it is here that chance comes into play in determining the kind of infection from which the animals suffer. Thus one batch of pigeons, imported for experimental use into this laboratory, had amongst them carriers of the invisible virus of *Epithelioma contagiosum*. The birds fed on rice diet suffered much from this condition, while well fed controls did not. Another batch happened to have amongst them carriers of B. suipestifer; the birds fed on the rice diets suffered much from this infection—itself capable of causing neuritis—the well fed controls did not. A batch of monkeys happened to have amongst them carriers of Entamoeba histolytica; dysentery appeared amongst the ill fed animals, while the well fed—amongst whom were also carriers—remained free from it. Thus did faulty nutrition favour infection by invisible virus, bacillus and amoeba.

It was found also that a number of other factors—age, sex, warmth, cold damp, chill, balance of the food, previous food conditions and above all, individual idiosyncrasy—influenced the onset of symptoms either in the direction of precipitating or of retarding them. Those that precipitated symptoms were such as placed additional burdens on the metabolic resources of the body: those that retarded them were such as conserved these resources. Thus, an addition of an excess of fats to the rice diet hastened the death of both birds and monkeys, while exposure to cold and damp precipitated the onset of oedema—an observation of significance in regard to malnutritional oedema and beri-beri. Associated with these symptoms of ill-health profound changes were found throughout the organs and tissues of the body; these were observable even by the naked eye and the relatively crude method of histological examination. Of these changes the most conspicuous were those in the gasto-intestinal tract, the circulatory system, the endocrine organs and the nervous system. They are now-a-days so well known that little further reference need be made to them; by analytical methods of experimentation many of them have since been traced to particular deficiencies in the diet.

In these observations a parallel is to be found in the poor stamina, muscular development and physical endowment of rice-eating races, and in low powers of endurance and resistance to infection of the poorer classes amongst the rice eaters. A parallel is also presented in the frequent occurrence amongst them of respiratory diseases, gastro-intestinal diseases (diarrhoea, dysentery, cholera, colitis) malnutritional oedema, anaemia, skin diseases and beri-beri Interest in the last named has, because of its occurrence amongst rice eaters, over-shadowed the vastly more important and more general effects of the rice-eater's diet. For, considering the millions whose staple article of diet is rice, beri-beri is relatively an uncommon disease in India. Its distribution is very limited; it is confined, as an endemic, to certain coastal areas of the north-east of Madras and Bengal. In Madras it is rarely seen at a distance of more than 50 miles inland. It is practically unknown on the West Coast of Madras and Bombay where as much rice per capita is eaten as in localities where it is endemic. Occasional small outbreaks (epidemics) occur in other parts of India, but, for the most part, these are in persons who have emigrated from endemic areas. In India endemic beri-beri is very definitely a " place disease ". I do not here speak of " epidemic dropsy " which some in India, consider to be a form of beri-beri Much of the confusion in regard to the causation of beri-beri has arisen from the fact that par-boiled rice and rice which is not highly milled and polished are supposed to contain " plenty of vitam B ". They do not. In this laboratory true beri-beri has been produced in pigeons fed exclusively on diets of undermilled or home-pounded rice or of washed par-boiled rice. A second source of confusion has been the assumption that *polyneuritis columbarum* is the same condition as beri-beri. It is an analagous condition certainly, but not the same condition; though it may arise under precisely the same dietary conditions as true beri-beri does. Thus if pigeons be fed on a diet simulating that in use by human beri-beries—washed polished rice plus 0·8 gram of dhal per bird daily, the latter administered artificially—some will develop no signs either of polyneuritis or of beri-beri, though they may suffer from other maladies within a period of 10) days; others will develop polyneuritis, columbarum others beri-beri columbarum; others again, a condition intermediate between these two states The individual indiosyncrasy of the bird is the final factor determining which condition it will suffer from or whether it will suffer from either.

These two conditions differ from each other as follows:— the former is a state of polyneuritis and cardiac atrophy with or without oedema; it is most readily and most regularly produced when the rice diet is very deficient in vitamin B. The latter is a state of polyneuritis, cardiac, hypertrophy and degeneration with (usually) or without (rarely) oedema; it arises when the diet contains an insufficiency of, but is not wholly lacking in, vitamin B. It is to this latter condition that the term " true beri-beri " can alone be accurately applied. Statistical examination of my experimental data has shown that it is due to an unknown positive factor acting in association with insufficiency of vitamin B. This positive factor is produced in the bodies of birds themselves, and is either a metabolic or a microbic poison. True beri-beri is an intoxication. It is still thought by some that the beri-beri poison can be produced in deteriorated rice outside the body. No evidence in support of this view has so far been forthcoming in the course of work in this laboratory.

There are, thus, a number of polyneuritis states which can arise in pigeons fed on rice-diets; infective polyneuritis due to a microbe such as the B. suipestifer; nutritional polyneuritis due solely to avitaminosis; true beri-beri, due to avitaminosis plus an unknown positive agent arising in the bodies of the birds in consequence of the avitaminosis; and intermediate states between nutritional polyneuritis on the one hand and true beri-beri on the other. If there be this diversiiy of " beri-beri-like " maladies in birds fed on rice diets it is reasonable to suppose that a similar diversity of these maladies will be found in human beings who subsist mainly on rice. All these forms of neuritis are preventable in birds by the same means; the addition to the rice—whether it be from deteriorated stock in use by human beri-beries or not—of a sufficiency of food materials (wheat, tomatoes, legumes, etc.) rich in vitamin B. Human beri-beri as it occurs in India, is also preventable by the same means and has been so prevented in 'jails where it is endemic for years. The prescription of ancient Indian Hakims— " stop eating rice and take a diet of wheat and milk ", can hardly be bettered.

So much then for the rice-eater's diet. What of the wheat-eaters? If animals (rats) be fed on an exclusive diet of whole wheat the mortality amongst them is very high. Pulmonary infection is the chief cause of death. If to the diet of whole wheat some good olive or sesame oil—which are poor but not wholly lacking in vitamin A—be added. together with a salt mixture to make up for certain mineral defects in the wheat, the animals live longer and afford greater opportunity for the study of the effects of diets comparable in composition to that used by the poorer class of wheat-eaters. The main deficiency of this diet is one of fat soluble vitamins. Its effects are exhibited as metaplasia of epithelia, throughout the body—a change now recognised as characteristic of vitamin A insufficiency. Infections of the eye, the nasal sinuses the lungs, are common; urinary calculus is frequent; the goitre is occasionally met with.

In the course of experimental work in this laboratory many variations of deficient diets, having one or other cereal grain or cereal product or a mixture of such as their basis have been used with results which manifest themselves, for the most part, as " it is's " of various kinds and locations. These need not be enumerated but some reference may be made to three conditions— " Stone ", goitre, and peptic ulcer ", which in India are problems of moment.

The distribution of " Stone " is peculiar; it occurs, for the most part, in the north of India and is relatively rare in the south. It is a disease of wheat eaters rather than of rice eaters. Experimental work in this laboratory has shown that the cereal grains in common use in India vary in their stone-producing potency, wheat having the highest, the rice the lowest potency, in this regard, while the other cereals occupy an intermediate position between these two extremes. The distribution of stone is therefore related to the distribution of cereal crops. The stone-producing potency of white flour is relatively low; and as white flour contains no more vitamin A than whole wheat flour it is obvious that in the process of milling some substance favourable to stone production is removed from the whole grain. There are two classes of factors (apart from infection and foreign bodies in the urinary tract) concerned in the causation of stone; negative ones—vitamin A deficiency and phosphate deficiency; and positive ones—an unknown substance existing in different amounts in different cereals, and excess of lime in the diet. Cattle stones are, in India, almost invariably composed of calcium carbonate. The dietary conditions under which they arise in nature or are produced under experimental conditions in the laboratory are the same: deficiency of vitamin A and deficiency of phosphates relative to the amount of lime in the diet. Work in this laboratory has convinced that, in India, urinary calculus is usually a disease of faulty nutrition.

The distribution of " goitre " is also peculiar: it occurs chiefly in Himalayan regions. In these the iodine content of the soil is low and no doubt also that of the food materials grown upon it. But the iodine content of the urine is not significantly higher in non-goitrous than in goitrous persons in these regions; and while admitting that iodine deficiency may favour the development of certain kinds of goitre, such deficiency is not regarded as the essential cause of the disease. With the possible exception of the adrenal glands and thymus, no organ or tissue of the body is more sensitive to food conditions than the thyroid. The iodine content, the fat content, the lime content the phosphate content, the vitamin content of the food—all these influence its size; as do certain unknown substances in food materials such as cabbage. and groundnuts. Its size also is influenced in certain circumstances by insanitary conditions of life. Iodine is by no means the be-all and the end-all of goitre. Four etiologically distinct types of goitre have been produced in this laboratory—the hyperplastic, the hypertrophic, the colloid and the lymph adenoid—but all have this in common: they are preventable by the same reasons. This means the provision of a perfectly balanced diet such as the lacto-vegetarian one previously described. Thus, insanitary condition—a positive goitrogenic agency—will not cause goitre when the animals are properly fed; it will cause goitre when they are not. Goitre is, in the main, a disease of faulty nutrition; but, like beri-beri and like urinary calculus, both negative and positive factors are concerned in its causation.

"Peptic ulcer" has also a peculiar distribution. It is very common in the south of India—particularly in Travancore. It has been shown in this laboratory that the tapioca diet of the poorer class Travancorian will cause this condition in 27 per cent. of albino rats fed upon it: that of the poorer class Madrassi, 11 per cent.; while the lacto-vegetarian diet of the Sikhs affords the animals complete protection against it. Some 10 years ago it was observed, in this laboratory, that deficiency of vitamin C was capable of causing duodenal ulcer in guinea-pigs.

A pernicious type of anaemia may occur in albino rats when they are fed on a diet of oatmeal, linseed meal and patent flour. It is due to rat house-borne organism: Bartonella muris. As is well-known this organism gives rise in these animals to a profound anaemia on removal of the spleen It is of significance, in regard to such maladies as malaria, typhus, relapsing fever and Kala-azar—all widely prevalent in India and favoured in their course and development by famine conditions—that the protective resources of the spleen can be injured by faulty nutrition in a way comparable to that brought about by splenectomy.

Other diseases of faulty nutrition—keratomalacia, night-blindness, rickets, osteomalacia, tetany, dental caries, scurvy, pellagra, anaemia of pregnancy, lathyrism—all concern us, to a greater or lesser extent in India; and many other conditions, such, for instance, as cataract and sprue, may have a malnutritional basis of the nature of which we as yet know but little Keratomolacia is common, and is the chief cause of preventable blindness (Wright 1931). It occurs in undernourished, poverty stricken persons, whose diets are not only deficient in vitamin A but in other vitamins as well. "In all probability it requires an initial multiple vitamin deficiency, with a secondary multiple disfunction of glandular structures to account for the whole picture of degeneration, loss of function, wasting, necrosis, secondary infection and death which we see in kerotomalacia." (Wright 1931). Night blindness is also common—well known to ancient Hakims in India who treated by the administration of liver. It is frequently associated with lathyrism in localities where the latter condition prevails (McCombie Young, 1927). "In Northern India and Kashmir rickets in its various forms, osteomalacia, late rickets and infantile rickets, tend to occur in any race or caste wherever there is deficiency of sun light or diet, or more frequently where there is a relative deficiency in both these factors." (Wilson, 1930, 1931). It is of a greater severity amongst those who observe purdha couditions of life. Osteomalacia accounts for much maternal mortality in child birth (Vaughn). Tetany is frequently associated with rickets; it is endemic in certain valleys of the Himalayas (McCarrison 1910). Dental caries and hypo-plasia are widespread amongst Indians whose diets are composed mainly of cereals and are deficient in fat soluble vitamins and vitamin C. If deficiency of vitamin D be the chief cause of dental caries it is obvious that tropical sunlight does not provide enough for its prevention. Scurvy, usually in minor form, is wide spread throughout the whole of India; and pyorrhea alveolaris is frequently to be found in persons whose diets contain far too little fresh vegetable foods. Pellagra appears to be relatively rare. The anaemias of pregnancy are common; they are malnutritional in nature, occurring in women whose diets are both quantitatively and qualitatively deficient (Wills. 1928–31). Epidemiological investigations carried out by McCombie Young (1927) from this laboratory, have shown that lathyrism is associated not only with the predominance of lathyrus sativus in the diet but with undernutrition and deficiency of fat soluble A.

The problem in connection with all these diseases is no longer one of lack of knowledge of their nature, nor of their means of prevention; but one of the improvements of conditions of living and of food supply of the people. Indeed, the greatest of all problems in India at the present time is the adjustment of the population to its food supply. It is one that is capable of solution only by the people themselves; by the exercise of self-help; by the jettisoning of old habits and customs unsuited to modern economic conditions; by improvements in methods of agriculture, animal husbandry and industry; and above all by restraint in re-production.

Recently (1931) I had occasion to contrast the incidence of disease in 2243 improperly fed albino rats with that in the well fed stock rats in this laboratory. It was shown that while the former exhibited a large proportion of the maladies included in the calendar of human ailments, the latter were remarkably free from disease of any kind. The only significant difference in their conditions of life was the improper feeding of the one " Universe " and the proper feeding of the other. It seems to me that, however deeply we may delve into the minutiae of the relationship of faulty nutrition to disease, the essence of the whole matter will be found to lie in this; the use of a properly constituted diet is a sure means to the attainment of physical efficiency and health. Such a diet is the lacto-vegetarian one in use by certain vigorous and resolute races of Northern India. *(From " Nutrition Abstracts & Reviews ", Vol. II, No. 2. July 1932).*

Notes and Comments.

Potato Breeding. The appointment, with the help of a grant from the Imperial Council of Agricultural Research, of an officer of the Department, to carry on breeding work on potatoes at the Nanjanad Agricultural Research Station, Ootacamund, marks yet another step forward in the march of agricultural science in the Presidency. The breeding work done in the earlier years, on major crops like sugarcane, paddy, cotton and the millets, has resulted in valuable strains being evolved and distributed over the country; the appointment of the Oil Seeds Specialist two years ago has similarly satisfied the growing need for improving the several oilseed crops, and the appointment of an officer to breed superior varieties of potatoes, will therefore be hailed with satisfaction by all those interested in agriculture, especially as in modern days the tendency has been to depend not merely on any one crop, but on as many suitable ones as possible to make agriculture more paying.

A New Agricultural Farm at Pattukottai. It is very gratifying to understand that the Irrigation Development Board have resolved to recommend to Government for acceptance, the proposal of the Director of Agriculture to have a Demonstration Farm in the Cauvery-Mettur area preferably in the Pattukottai taluq. Research work on agriculture and allied sciences, to be of benefit to the masses, must go along with more propaganda and demonstration, so that ryots might come to know and take advantage of the improvements suggested by the Department. The Agricultural Research Station at Aduthurai, which is the only one in the V circle comprising the Trichinopoly and Tanjore Districts, is more an experimental station with a definite aim, but the proposed Pattukottai Farm will remove a long felt want for demonstration in improved methods of agriculture, in a district, which is second to none in agricultural importance. We hope that Government will give effect to the recommendations of the Irrigation Development Board.

The World Poultry Congress. The Fifth World Poultry Congress with a grand exhibition is to be held in Rome from the 6th to the 15th of September 1933 under the high patronage of His Majesty the King of Italy. These international Poultry Congresses are being held at the initiative of the World's Poultry Science Association and their main aims appear to be the establishment of friendly relations between the various categories of persons interested in the development of the poultry industry, the pooling of the most recent knowledge regarding the raising of courtyard animals, the development of scientific research work and instructions in connection with poultry-raising, to make known the most rational devices used in that connection, to encourage, through appropriate measures the trade in poultry products, and, by means of international exhibitions, to spread the knowledge on the subject. The Congress is held every third year. The first was held in Holland in 1921, the second in Spain in 1924, the third in Canada in 1927, and the fourth in England in 1930. We hope some of the Poultry Associations in India may be able to depute their representatives to this show, so that they may return with knowledge of up-to-date methods in the Science of Poultry. We are also publishing a brief paper on this subject in this issue

The Sugar Industry in India. It is very encouraging to find that with the protection now offered by Government, there are signs all over the country for an active revival of this important industry not only in proposals to grow sugar cane in larger areas in different parts of the country, but also in starting investigations on the manufacture of both white sugar and superior jaggery. A number of sugar companies have been floated in Northern India recently and even in Madras there has been sufficient enterprise shown. While Mysore was the first in launching a scheme to open a sugar factory in the Irwin Canal area, we are glad to hear of another similar enterprise in Bellary. The company which has just been advertised inviting shares, proposes to start work in Hospet which has always been considered the most suitable place in Madras for a sugar factory, and it is very encouraging to find among the directorate of this new company, the present Chief Minister of Madras and an Ex-Development Minister. We also understand that the Director of Industries is investigating into the possibilities of establishing a factory at a suitable place in the Ramachandrapur Taluk of the Godavary District, where sugarcane cultivation is being carried on, on an extensive scale. The idea appears to be to start this factory on a co-operative basis under the supervision of Government Whether the manufacture of white sugar could be introduced as a cottage industry under south Indian conditions was being investigated by the Industries Department who were trying at one or two centres "The open pan system of white sugar manufacture" described by Mr. B. C. Srivatsava, Sugar Technologist to the Imperial Council of Agricultural Research. While the manufacture of white sugar on a factory scale is expected to replace a portion of the foreign white sugar imported into the country, it can never replace the manufacture of jaggery completely. Due to the poor quality of the jaggery offered on the market, people have to go in for white sugar in spite of its higher price. If a simple process could be evolved to make the jaggery manufactured by individual ryots better in quality and appearance, it would be generally welcomed, as it should mean a better price and hence a greater return to the cane grower and a cheaper product for the middle class consumer who now goes in for white sugar. We are glad to note that investigations on this point have already been initiated at the Research Institute, Coimbatore. The Agricultural Chemist has been conducting experiments and has succeeded on a laboratory scale in producing jaggery almost as white as sugar using activated charcoal prepared from paddy husk and has also held a demonstration at Anakapalle. We understand that during the coming cane crushing season more demonstrations of the improved method will be arranged all over the Presidency.

Marketing of Tanjore Rice We made a reference to this subject in our March issue drawing attention to the hard position in which the Tanjore rice growers were placed. As a result of the strong representation made to the Railway authorities about the reduction in freight, the South Indian Railway and the Ceylon Railway have agreed to reduce the present rates by 16%. This in the opinion of the Tanjore people, is not enough as they feel that for them to be able to successfully compete with Burma in the Ceylon market the present rates must be reduced by at least 30%. Meanwhile at a public meeting held recently in Tanjore it has been decided to form a syndicate consisting of Mirasdars and mill-owners of the district for developing and maintaining markets for Tanjore rice. The meeting has also formed a strong committee of men including the Deputy Director of Agriculture, V circle, and the Deputy Registrar of Co-operative Societies, Tanjore, to frame rules for the formation of the syndicate. The idea appears to be that the mirasdars should entrust this surplus paddy to the association which will arrange for its milling, the mill-owners being paid their hulling charges and a fair rate of interest for their capital. The milled rice would then be sold in inland and foreign parts and the profits left over would be distributed to the mirasdars in proportion to the paddy supplied by them. The Association is to be registered either under the Co-operative Societies Act or under the Joint-stock Companies Act. We wish the syndicate all success in their endeavour to alleviate the suffering of the delta cultivators. We are also glad to hear that efforts are being taken to open up the port of Tranquebar and afford facilities for the export of rice through the port.

ABSTRACTS

Geographical Aspects of Cane-Sugar Production. *C. J. Robertson, (Geography,* 1932, vol. 27, part 3). In the present paper, the author has reviewed the factors which have influenced the localisation of sugar cane production and manufacture in certain parts of the world like the West Indies, Java etc. Climatic and soil factors, like moisture, temperature, incidence of rainfall, nature of the soil etc., have a great determining influence in delimiting the cane area of the world; thus, sufficiency of moisture at the critical period of maximum vegetative growth is an important factor in securing good yields. In Java, where the cane is mostly planted from June to September, the critical period as regards moisture is found to be October-November (when the crop is 2½-3½ months) and Tengwall and Van der Zyl have worked out the following formula relating precipitation with yield:—

$x_1 = 79{\cdot}75 + 0{\cdot}0504\ x_2 + 0{\cdot}506\ x_3 + 0{\cdot}3132\ x_4$, where x_1 is the production of standard muscovado (raw sugar) in pikuls (about 110 lbs.) per bouw (1·7537 acres), x_2 is the precipitation in October, x_3 is the precipitation in November and x_4 is the percentage of total crop planted before 1st August. In the eleven years 1912—23, the difference between the yield calculated by this formula and that actually obtained averaged only 2·9 %. It has been demonstrated both at Java and at Mauritius that the months statisticalty found to be critical for moisture are those when the young cane is growing most rapidly at the beginning of the wet season. A period of drought at this stage of vegetative activity stunts the internodes, kills the leaves, increases the fibre and acidity of juice. The period of vegetative growth should be followed by a well marked dry and cool season when the crop matures and sucrose accumulates. Irrigation facilities whereby the moisture supply can be controlled give higher yields than dependance on rainfall even though this may be sufficient and they have the advantage that the cane may be grown independently of the season and the factories can be operated for a much longer period—as in Hawaii for ten months in the year and in Peru all the year round—thus greatly reducing overhead costs. As regards the effect of temperature in limiting cane growth, observations at Peshawar have shown that the buds are practically killed when the mean minimum temperature (of December—January) falls to 52° F; there is very little growth below 68°F; the growth increases thereafter up to 88°F. Coimbatore observations showed maximum growth at 105 ° F. There was poor germination when temperature was above 117 ° F at planting and the buds were killed by temperatures of from 122 ° F to 131 ° F. The harmful effects of frost and severe wind are well known; frost adversely affects the quality of the juice as it causes inversion of the sucrose and increases the viscosity of the juice.

In regard to the influence of soils on the distribution of the cane crop, the author notes that the plant thrives best on loams and well drained clays and prefers a slightly alkaline soil. The chief cane soils of Cuba are the Matanzas clays which can be cultivated even within a few hours after rain. In other areas, red soils have been very popular for cane growing, on account of their ease of working and good drainage (Hawaii, parts of Cuba, Mauritius, Natal, Deccan, Queensland etc), but owing to the leaching effect of tropical rains these soils are getting poorer in lime and phosphoric acid and they are also poor in humus and nitrogen. Alluvial lands in Natal and Queensland have maintained their yields for a long period. But from the historical stand point, the determining influences which have localised the cane tract in a few islands like Cuba, Java etc, have not been so much the above factors, but rather political considerations like the backing of an organised group of capitalists and the security of a contiguous market. American capital and tariff concessions have made Cuba the leading world producer of cane sugar (4·7 million metric tons in 1929—30 out of a total world production for cane and beet sugar of 26·0 million tons). Dutch capital and enterprise have similarly controlled the Java industry. Insufficiency of labour and local sparsity of population have not proved limiting factors to the development of cane production in the above areas. (C. N.)

A Sensitive pot test for Phosphate Deficiency in soils *J. A. McDonald* (*Tropical Agriculture*, (Trinidad), 1933, vol 10. pp 108-111). The author utilises the tomato plant as a sensitive indicator of the phosphorus requirement of soils. Tomato plants grown in phosphate deficient soils (below about 40 parts per million of available phosphorus) showed the following abnormal symptoms;—(1) A violet red colour developed on the lower sides of the leaves and stems (most marked after 10 to 20 days growth), (2) The stems and foliage had a darker green colour than normal. (3) The plants showed great response, in respect of dry matter produced, to additions of soluble phosphorus to the soil. (4) Some times, in extreme cases of phosphate deficiency, the first pair of true leaves remain unparted at the tips, and there is an upward inclination of seed-leaves forming an acute angle. For determining qualitatively the phosphate deficiency of a soil, the author suggests a pot experimental method, where-in 4 pots are used, in two of which the sample of soil is used as such without any addition, and in the other two the soil is mixed with soluble phosphate. From the difference in growth of tomato plants in the two sets of pots and by observation of the foliage symptoms, the degree of phosphate deficiency is inferred. The method is claimed to have advantages over chemical methods like Truog's colorimetric method, especially for alkaline and calcareous soils, where a sufficiency of phoshate may be shown by chemical methods but the phosphate may be in an " unavailable " condition as revealed by the tomato test. (C. N).

The influence of different levels of fat intake upon milk secretion.— *L. A. Maynard* and *C. M. McCay*, (*Bulletin No. 543 of the Cornell University Agricultural Experimental Station*, Ithaca, New York, 1932). The experiments reported in the present paper throw interesting light on a question of practical importance to the dairy farmer, viz., whether the fat ingested in the food has any influence beyond its energy value on total milk secretion and the fat content of milk. The experiments covered a period of three years from 1928—1931 and involved nineteen cows in all. The influence of different fat levels on milk secretion was studied, by partial or nearly complete removal of the fat from the grain mixture by benzine extraction and its replacement by an isodynamic amount of starch. The data obtained show that the fat content of a dairy ration has a special value in addition to that represented by its energy content. The replacement of one half or more of the fat in a 6 or 7% fat grain mixture by an isodynamic amount of starch, uniformly resulted in a lowering of the yield of milk and of fat. When the fat ingested was reduced to 1%, the fall in milk yield was most marked. The primary effect of ingested fat was on the total milk secretion and not on the fat percentage which latter sometimes tended to go up in inverse relation to total milk yield. The present studies suggest that maximum milk secretion is favoured by a fat intake which would be sufficient to provide at least a major part of the fat secreted in the milk. In the present experiments wherein the succulent used viz. beet pulp, was abnormally low in fat, a level of 3% fat in the grain mixture proved insufficient for maximum milk production. It is interesting to note that at each of the fat levels 1%, 3% and 7% in the food supplied, the total fat secreted in milk was greater than that ingested in the food, the difference being greater in the case of low fat supply; the difference in fat was synthesised from the carbohydrate supplied. Such substitution of carbohydrate for fat in the metabolism was immediately reflected in the quality of the secreted fat as shown by its higher iodine number. The lowering of the fat intake, with its resultant decrease in milk secretion, was accompanied by a gradual lowering of the total fatty acids, the phospholipid fatty acids, and the cholesterol of the blood plasma. The changes in these lipids exhibited a high degree of parallelism. (C. N.)

The Effect of Different planes of Protein Intake upon milk production. *E. S. Harrison* and *E. S. Savage* (*Bulletin No. 540 of the Cornell University Agricultural Experimental Station*—Ithaca. New York.—May 1932). The pamphlet makes an interesting contribution to the important question of the protein requirements of dairy cows, about which so few data are available under Indian conditions. In order to examine the scientific soundness of the general tendency of American Dairy farmers to feed too much of protein to milch cattle, the authors carried out experiments over two years on three batches of 12 Holstein cows each, which were fed on three different protein levels, viz., 16%, 20 %, and 24 % of protein. The protein supply was secured by means of concentrated bran, linseed meal, cotton seed meal and corn gluten feed, which were mixed in such proportions as to make three mixtures containing the same percentages of fat, fibre and total digestible nutrients per ton, but one carrying 16 %, the second 20 % and the third 24 % total protein. Roughages like hay and corn silage were fed to all the groups. A statistical analysis of the data showed that there was no significant difference between the total yields of milk in the three groups, which averaged from 9500 to 10,000 lbs. during the first 40 weeks after lactation. There was also no significant difference between the groups in the efficiency with which the three groups utilised their rations. Generally, about thirty lbs. of concentrate, 37 lb. of hay and 110 lbs. of silage were required in each case for the production of 100 lb. of milk, representing about 0 27 to 0·28 lb. of total digestible nutrients in addition to maintenance requirements per lb. of milk produced. When 0·7 lb. of digestible protein per 1000 lbs. of live weight is deducted for maintenance, the ratio of the digestible crude protein consumed to the protein produced in the milk was in the 16% group 127·8%, in the 20% group 149·8%, in the 24% group 180·6%. The 16% concentrate mixture furnishing 127·8% of the protein in the milk was just as effective in maintenance of milk production as either the 149·8% or 180·6%. There was no evidence of a stimulating effect of the higher protein feed on total milk production. (C. N.)

The Marketing of Fruits and Vegetables in Bombay. *G. S. Cheema* (*Government Central Press, Bombay*, 1932). In this interesting pamphlet Dr. Cheema, who has recently been on a visit to the fruit-markets of Europe, points out the disorganised state of the production and marketing of fruits and vegetables in India, and discusses measures necessary of adoption, if India is to improve her trade in these primary commodities. Public interest in the fruit export trade of India has recently been roused by the attempts made by the Bombay Department of Agriculture under the auspices of the Empire Marketing Board, during the last and current season to send consignments of the best Indian mangoes for the English market. The present pamphlet limits itself to Bombay city only and Dr. Cheema points out that the per capita consumption of fruits and vegetables in Bombay is only half an ounce per day as compared with 1 lb. per day in New York, 4½ oz. in London and higher still in Paris. The reason for this low consumption, especially in a predominantly vegetarian country like India, is attributed to two principal factors namely (1) high prices and (2) the faulty distributing organisation, especially as regards meeting the requirements of the poor man. The high prices have, in fact encouraged the import of fruits into Bombay from foreign countries, eg. dates from Iraq, oranges from Palestine, Rhodesia and Italy, grapes from Spain, potatoes from Italy etc. the total value of the imports being nearly a crore of rupees per year. An analysis of costs of local production showed that 71% of the retail price of fruit is taken by the middleman, 18% is absorbed in freight and only 11% goes into the pockets of the grower. In order to avoid the high middle-man and transport charges, Dr. Cheema recommends the formation of a Marketing Board for fruits and vegetables, similar to the Market Committee provided in the Bombay Cotton Markets Act of 1927, which shall have entire control in the grading and packing of the produce, issuing licenses for registered auction agents, fixing prices to prevent unjust price fixing, issuing certificates regarding the spoiled condition of consignments, maintaining an information bureau to publish wholesale and retail prices etc Besides the formation of the Marketing Board, the author recommends the immediate separation of the wholesale market from the retail market, the substitution of free auctioning in place of secret sales in the wholesale markets and sufficient publicity for the wholesale prices. Transport facilities should be increased by a lowering of freight, speeding up of transport by means of through-scheduled trains and provision of special vans with good ventilation for the carrying of fruits and vegetables and the provision of special refrigeration cars. (C. N.)

Production of Industrial Alcohol from grain by the Amylo Process. *W. L. Owen* (*Industrial and Engineering Chemistry*, 1933, vol. 25, pp. 87–89). This article describes some of the recent improved methods for the manufacture of alcohol from maize, which may prove of interest in this country, as suggesting a possible outlet for the large quantity of cereal grains like cholam and maize grown in India. The Amylo process, developed by Calmette and Voidin at Antwerp, is a scientific improvement on the age old Chinese process, wherein the white mould *Amyloces Rouxie*, growing on rice doughs, was used. Saccharification and alcoholic fementation are hastened by the use of powerful ferments like purified cultures of *Mucor B*, *Mucor G*, *Rhizopus Delemar etc.*, besides *Amyloces Rouxii*. The Amylo process is complete in about three days, but in a still later improvement called the Boulard process, the reaction is finished in 48 hours, being hastened by the simultaneous carrying out of the saccharifying and alcoholising fermentations side by side and the use of still more powerful ferments like Mucor Boulard No. 5. The Amylo and Boulard processes possess several advantages over the older malt-method of bringing about saccharification since there is a saving in respect of barely malt used, which in the older methods went up to 10 to 15% on the total grain mash, and moreover higher yields of purer quality alcohol were obtained. The saving in malt alone caused a difference as between 1 sh. 6½ d. per gallon of 95 per cent. alcohol by the malt method and 11¼ d by the Amylo process. The yield is about 37-39 liters by the Amylo method as against 34 liters by the malting process. Moreover the higher temperature (about 40°C) at which the Amylo process can be carried out, due to the use of special yeasts like *Saccharomyces anamensis*, and Boulard No. 21-30, destroyed other infecting ferments and yielded a finer quality of alcohol. (C. N.)

Gleanings.

Leather Waste as Chicken Feed—The leather industry has for many years furnished the glue manufactures with millions of pounds of raw material each year, and from this certain technical gelatins and animal glue have been processed. With conditions as they are at present due to the economic situation, the glue manufactures are affected like all other industries. The glue industry has further met with reduced demands during the past year or so, due to the trend in furniture, steel or other metal furniture supplementing wood furniture to an appreciable degree. With all these conditions there was no demand for the raw material from which to manufacture animal glue. When it became apparent that huge quantities of this raw material were accumulating all over the United States, the Department of Leather Research of the University of Cincinnati undertook the problem of finding ways and means of utilising this material. Many research problems were started and the one which to date has given most promise is the processing of this raw stock into a protein concentrate food-material. The process involved is simple. By the fine subdivision of the material and an intimate heating, the moisture is reduced to a low percentage Meat scrap and tankage are usually sold on a 50% protein basis. The new food should compete with these materials, for its protein content has been found to be from 60—67%. (*Scientific American*, February, 1933).

Silver Purifies Water. Metallic silver in an ionic condition appears to exercise a very effective bactericidal action on the germs which are usually present in drinking water. Various means of introducing silver ions into water are described in a recent issue of *Chemical Age*. An electrical method recently proposed involves the passage of the water between silver electrodes through which a very small current is continuously passing. By this method an effective number of silver ions are introduced into the water with the aid of a three to five milliampere current. One of the earlier methods of purification was based upon the ability of water to take-up silver by merely allowing it to trickle over glass beads coated with a thin layer of the metal. A suitable small-scale plant consists of a 25-quart stone-ware jar filled with a quantity of silver coated glass beads which reduces the capacity to 18 quarts. The water is passed into the jar via a tube filled with silver-coated quartz fibres, and a velocity of flow of half to one quart per minute suffices for thorough disinfection. A curious feature of this catodyne process is that water sterilised in this manner can itself be used as a sterilising agent for mineral water bottles and the like. It appears that on allowing such silver-charged water to stand in a glass bottle for several hours, a proportion of the ionic silver becomes transferred to the walls of the bottle and serves to sterilise any liquid subsequently poured into it. (A. E. B. in Scientific American, March 1933).

Mosquito Horde Kills Live-Stock. A furious attack by a mosquito horde near Miame, Floride, resulted in the death of at least 173 head of live-stock and poultry, F. C. Bishopp of the Department of Agriculture reported to a recent issue of *Science*. While blood loss was an important factor, Mr. Bishopp is of the opinion that the death may have been due to the injection of a toxin by the mosquitoes as well as the loss of blood. He points out that few of the current reports of fatal attacks on man and animals by mosquitoes have been verified. The check of the losses in this instance was made by T. E. McNeel of the United States Bureau of Entomology *Science service.*

New Fertilizer from Peat. Ammoniated peat, a new fertiliser material has been developed in the laboratories of the United States Department of the Agriculture. It seems to combine many of the good features of the two familiar types of nitrogen carrying fertilisers. It has not been developed commercially yet, but chemists of the department say that the manufacturing process is simple and relatively inexpensive and that the commercial production of ammoniated peat offers opportunity for material saving in freight on fertilisers. Small scale experiments with plants have given promising results. By heating ammonia and peat under pressure, about two thirds of the reacting ammonia is changed to chemical combinations that are not soluble in water. These forms are generally similar to the nitrogenous fertiliser materials in cotton seed meal and animal tankage. Roughly a third of the ammonia remains in water-soluble forms. Depending on temperature, the peat may be ammoniated so that it will consist of as much as 20% of nitrogen. A 20% product would thus contain in each 100 pounds the equivalent of 200 pounds of cotton seed meal plus 50 pounds of sodium nitrate. Raw peat is of relatively little value as a nutritive ingredient in fertilizer, but is recognised as a highly desirable element in mixed fertilisers because of its value as a conditioner, preventing the caking of the product and because it applies to the soil, a desirable form of organic matter. (*A. E. B. in Scientific American*, April 1933.)

Heterosis: Specific not General in Nature. In studies of hybrid vigour in F_1 oat plants, variable results were obtained from different crosses. In the F_1 of some crosses nearly all the measurable parts are greater in the F_1 hybrid than in the larger parent. In other crosses possibly only one or two characters are noticeably increased. The difficulty of obtaining oat crosses in large numbers is a serious obstacle to studies of heterosis in oats, but it is believed that an increase of 10% over the larger parent may safely be considered a significant increase where small numbers are involved. Examples of these results are found in the cross *Fulghum Richland* × *Markton*. In the first cross the F_1 plants averaged 13·2 per cent taller, bore 17·5 per cent. more culms per plant, weighed 48·5 per cent more, and yielded 35·2 per cent. more grain and 51·3 per cent. more straw on the average than the larger parent. In all other characters the hybrids were intermediate between the parents. In the second cross the F_1 plants yielded 18·9 per cent. more grain, and the grain-straw ratio was increased 33·8 per cent. over that of the larger parent. In all other characters the F_1 plants of this cross were intermediate in size between the parents. In other crosses other characters manifested the influence of heterosis.

Heterosis is commonly accepted as having a genetic basis and as such this increase in plant size is satisfactorily explained as being due to the bringing together in the F_1 of the growth factors present in both parents. The impression seems quite generally held that when heterosis occurs in an F_1 hybrid individual the increased size is of a more or less general nature, extending to all or almost all the measurable parts of the hybrid organism. In the light of available knowledge it appears that this widely held conception may need some revision. Barring actual linkage, heterosis is a condition which more often has a rather high degree of specificity. In some crosses a number of the parts of the F_1 hybrid plant may show influence of heterosis, yet it does not necessarily follow that the parts are closely linked genetically. The fact that in some F_1

crosses only a single plant part shows the influence of heterosis, while in others there may be several showing increased size, definitely indicates lack of genetical linkage. (F. A. Coffman, *Science*, January 27, 1933. Vol. 77 No. 1987).

Correspondence.

I

Potatoes in Nilgiris.

The Secretary of the Association of Economic Biologists writes:—

In the report of a meeting of the above Association published in the March issue of 1933, I regret that certain inaccuracies occured which have since been brought to my notice and I request that you may publish the following alterations in that report.

(1) Para 4. (3) Second crop September—December 33,000 acres should read as 3,300 acres.

(2) Para 5. A bag is 200 lb., and not 80 lb.

(3) Para 6. Second line, in place of kidney read Royal kidney.

II

An Appreciation.

Mr. R. C. Wood, Professor of Agriculture, Imperial College of Tropical Agriculture, Trinidad, and formerly Principal of the Coimbatore Agricultural College writes:— May I take this opportunity of tendering my congratulations to the Union and those responsible for the Journal, on its twenty first birthday. I remember, and I suppose was partly responsible for, itsappearance under the title of the Journal of the "Madras Agricultural Students' Union".

It is interesting to compare its age with other similar Journals. "The Tropical Agriculturist" (Ceylon) is the oldest, now in its 79th half year; "The Agricultural Journal of India" had reached its 25th year, but is now discontinued. "The Malayan Agricultural Journal" and the "Philippine Agriculturist" are contemporaries.

You have a record to be proud of, and I wish you all success for the future.

Crop & Trade Reports

Groundnut Crop, Madras 1933, First Report. (1) The area sown with the summer or irrigated crop of groundnut during the three months of January to March 1933 is estimated at 49,200 acres as against 40,600 acres for the corresponding period of last year, an increase of 21 per cent. (2) The wholesale price of groundnut per imperial maund of 82 lb as reported from important market centres towards the close of March, ranged from Rs. 3—3—0 to Rs. 3—4—0. (*From the Board of Revenue, Madras*).

All India Memorandum on the Sesamum Crop, 1932—'33. The total estimated acreage and yield of sesamum *in India in 1932—33* is 5,982,000 acres and 545,000 tons, against 5,639,000 acres *and 476,000 tons, for 1931—32 and 5,373,000* acres and 486,000 tons for the average of the five years ending 1930—31. The shares of the different Provinces are: Burma, 1,534,000 acres, 64,000 tons; United Provin- 1,221,000 acres, 132,000 tons; Madras 806,000 acres and 106,000 tons; Bombay

602,000 acres and 73,000 tons; Central Provinces and Berar, 591,000 acres and 51,000 tons; Bihar and Orissa, 200,000 acres and 29,000 tons; Bengal 161,000 acres and 36,000 tons; Punjab 135,000 acres and 11,000 tons; Hyderabad 601,000 acres and 35,000 tons; Increase of area and yield over the average of the preceding 5 years is greatest in Burma (32·4% in area and 33·3% in yield) and the United Provinces (39·4% in area and 64·0% in yield). The yield per acre is highest in Bengal (501 lbs. per acre) followed by Bihar and Orissa (325 lbs. per acre), Madras (295 lbs. per acre) and Bombay (272 lbs. per acre). The quantity exported by sea from British India to foreign countries during the last five years ending 31st March was as follows:—1928—29, 30·483 tons; 1929—30,10·789 tons; 1930—31, 1116 tons; 1931—32, 12,322 tons; and in 1932—33, 10,322 tons.

Condition of Important Industries in the Madras Presidency. The trade and industrial depression reduced the international trade of the world in the last quarter of the year under review to less than half of what it was in the corresponding quarter of 1929—30. Unsettled political conditions also adversely affected trade. The Madras Presidency being a province dependent mainly on its primary products, felt the effects of the depression acutely. The cotton and jute industries in this Presidency had a comparatively favourable year. Production and employment in hosiery mills also increased above the figures for the previous year. However, the tanning industry suffered severely and exports declined by 10% in weight and 17% in value owing largely to the increase in tariffs in several countries. Employment in the oil milling industry and in rice mills declined. The engineering industry also employed fewer people than before. The timber industry fared no better, political conditions in Bombay being the cause of reduced demand. The tile industry on the West Coast and the cigar industry have also been depressed. However, the production of soap in the Madras Presidency has increased and several new factories have been started, mostly by students who have passed out of the Kerala Soap Institute. In the tea planting industry prices have been on the downward grade for about two years but the unfavourable prospect is likely to be relieved to a partial extent by the British preference granted to Empire grown tea. The Indian Tea Cess Committee has been active throughout India in propaganda for the increased consumption of tea. Good crops of coffee were yielded during the season but there was a heavy fall in exports. On the other hand the demand for local consumption appears to be steadily increasing and thereby rendering the Indian producer less dependent on outside markets. There has been an improvement in prices. The rubber planting industry has been extremely affected. Most Estates ceased tapping during the year, but some continued production in anticipation of an agreement between England and Holland in regard to the restriction of output. As no such agreement was reached, tapping had by the close of the year in many cases ceased. The Industries department in co-operation with the department of Agriculture launched a campaign for increasing sugarcane cultivation and the manufacture of sugar, with a view to making the Madras Presidency self-support- in this respect. It is hoped to introduce hand or power driven centrifugals for economic manufacture of sugar in small factories.

Kerala Soap Institute. During the year the institute was appointed as Soap-makers to His Excellency the Earl of Willingdon, Viceroy and Governor-General of India. In spite of the general trade depression there was improvement over the previous year's figures both as regards production and sale of toilet soaps. Sales increased from Rs. 2,23,553 in 1930—31 to Rs. 2,41,698. The result of the year's working was a net profit of Rs. 12,436, after paying the interest of Rs. 19,885 on the capital invested by Government and meeting the cost of the educational side of the institution. This compares with a loss in the two previous years. During the year 16 students were trained in soap making. Some of the students have started soap factories of their own. In the laboratory of the Institute 630 analyses of oils, soaps and other products were conducted during the year. Some original research work was also done.

Government Industrial Institute, Madras. The experiments during the year consisted principally in finding cheaper substitutes for raw materials, their treatment and the effect of their use on the quality of finished products in the manufacture of printer's inks. A series of experiments were made for investigating the cause of corrosion in copper stills used for distilling *mahua* flowers. Enquiries regarding the manufacture of fluid inks, fruit preservation, extraction of various oils etc., were dealt with and replies furnished. Printer's ink was manufactured and 5,000 lbs. were supplied for the use of the Government Press.

Sandal-Wood Industry in the Madras Presidency. The administration report of the Forest Department of the Madras Presidency for the year ending 31st March 1932, states:—672 tons of sandalwood were sold for Rs. 6,12,802 as against 564 tons for Rs. 4,40,755 in the previous year. The average price realised was Rs. 912 per ton as against Rs. 782 in the previous year; Rs. 1395 in 1929—30 and Rs 1485 in 1928—29. That it was possible to dispose of the whole of the stocks and at better prices was satisfactory; but this market remains very uncertain, only small quantities at a time being in real demand. Efforts have been made in conjunction with the High Commissioner to establish direct touch with users and samples are being sent for analytical trial to European oil distillers. It is of interest to recall that in 1913—14 the average price realised was Rs. 558 and in 1924—25, Rs. 1596, the highest on record. In the last ten years 6462 tons have realised Rs. 77,21,818, the direct costs of production being only a little in excess of Rs. 5,00,000. It is thus evident how important a source of revenue this is and also that it is worth while to spend on research and cultural work far more than is devoted to the purpose at present. Rao Bahadur K. R. Venkatramana Iyer was deputed to study market conditions in the year and has submitted a valuable report. There is a considerable import of sandal substitute from Australia, Africa and other countries, which are sold to an unsuspecting public at genuine sandalwood prices. It is proposed presently to address Government with a view to an increase in the import duties. Efforts to effect retail sales of small quantities at a time for ceremonial and other personal use have not so far met with much success.

Quinine Manufacture in the Madras Presidency. The work of the Government Quinine factory at Naduvattam was hampered by the meagre supply of cinchona bark available for quinine extraction, and production was again maintained at a low level. Bark was not easily available as cinchona has been all but ousted in the locality by tea plantations. A quantity of 517.564 lbs. of bark was worked, of which 392,986 lbs. were locally purchased and the remainder obtained from the Government plantations at Naduvattam and Dodabetta and in the Anamalais. The output of quinine sulphate was 22,307 lbs. and cinchona febrifuge 9084 lbs. The factory cost of production of quinine sulphate was Rs. 13—8—4 per lb. A trial consignment of " totaquina " a purified form of cinchona febrifuge, which has been sponsored by the Malarial committee of the League of Nations was made and distributed to various hospitals for trial. The selling of ' treatments " in Post Offices which was inaugurated in June 1930, made satisfactory progress and 2167 lbs. were thus disposed of as against 1290 lbs. in the previous year. An extent of 1958 acres was under cincona plantation in the three Government plantations at the end of the year. The plants in the Anamalais estate were affected by water logging owing to heavy rains. The Naduvattam plantation had favourable weather conditions and success was obtained there in the grafting and high grade ledger plants on the stout roots of *Cinchona robusta*. New nurseries were opened at Dodabetta and a number of cinchona seedlings were transplanted. The financial accounts disclosed a profit on the year's working of Rs. 22,790, a satisfactory increase of Rs. 13,103 over the previous year's results (Report on the Administration of the Madras Presidency, for the year 1931—32.)

Review.

Sugar Reference Book and Directory, 1932—33. (Published by Palmer Publishing Corporation, New York, U. S. A., price 5 dollars). This handy book giving facts and figures regarding the production of cane and beet sugar in the different countries of the world, opens with a world map showing the distribution of the chief beet and cane areas. The tendency during the last few years has been towards a greater development of cane and beet sugar locally in the different countries with a view to render each country self contained as far as possible in regard to sugar, the prominent exception being the United States, which mainly depends for its supplies on Cuba. Till a few years ago, the ambition of several favourably situated countries was to follow the lead of Cuba and Java, in producing a great deal more sugar than what was required for internal consumption and dumping the excess on the world sugar market. Cuba and Java were successful in such international sugar trade on account of favourable circumstances like the contiguity of assured markets like the U. S. A. for Cuba and India for Java, but latterly when a number of other competitors like the European beet countries and the South American cane growing countries entered the field, it was found that the supply was greater than the demand and there was a heavy slump in the market. In order to save the international trade, some of the chief sugar exporters like Cuba, Java, Czechoslovakia, Germany, Poland, etc. formed at Brussels in 1931 an international sugar council and arrived at an International Agreement at Paris in 1932, whereby definite quotas were assigned to each country for export, and production was decreased with a view to clearing off the heavy stocks on hand and maintaining world prices. Despite unfavourable trade conditions, the Agreement has been successful in as much as an appreciable portion of the stock on hand has been already cleared and the Council hopes to clear off all excess stock by 1935. But it is doubtful whether in view of the strong protectionist policy adopted by each country, international trade in sugar would again resume the prominent place it attained in the post-war days. The graphs given in the Directory showing the variation in annual prices of raw and refined sugar at New York from 1903—1932, show that the high peak was reached in 1920, when price reached 15·5 cents per lb. for refined sugar and 12·5 cents per lb., for raw sugar, but after 1923 prices have been falling rapidly, so that in 1932 they reached the low water-mark of 3·7 cents for refined sugar and 2·6 cents for raw sugar. The efforts made by Java and Cuba to counteract this by a limitation of production is shown by the fact that production in Java has been brought down from 3,115,080 tons in 1929—30 to 1,350,000 tons in 1933, and in Cuba from 4,746,000 tons to 2,050,000 tons in the same period. The total world production has shown a decrease from 28,427,000 tons in 1929—30 to 26,063,000 tons in 1932—33, while consumption has shown an increase from 26,920,000 tons to 27,451,000 tons in the same period, The production of India has increased from 3,079,000 tons in 1929—30 to about 4,400,000 tons in 1932—33; her consumption has also shown an increase from 4,051,000 tons to 4,950,000 tons in the same period. She imported about a million tons of refined sugar from Java in 1930—31, but with the increased import duties now imposed (18 rupees 2 annas per bag of 224 pounds) and the active policy of increasing local production at present being adopted by the Government of India, imports from foreign countries are likely to cease in a few years. The Directory besides giving a review of the present position of the sugar industry in each country with details regarding the number and addresses of sugar factories with their maximum annual production capacity, contains several interesting articles on topics like the economics of sugar by products, the molasses supply situation, improvements in sugar technology, the tariff rates of different countries etc., and wonld prove a useful reference book to all those interested in the sugar trade, (C. N.)

Weather Review (MARCH—1933)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	...	- 0·6	0·5
	Berhampore *	...	- 0·7	0·6
	Calingapatam	...	- 0·4	...
	Vizagapatam	0·5	+0·2	0·6
	Anakapalli *	0·3	+0·2	0·3
	Samalkota *	0·4	- 0·1	0·4
	Cocanada	...	- 0·5	0·4
	Maruteru *	0·1	+0·1	0·1
	Masulipatam	...	- 0·4	...
	Guntur *	0·1	- 0·2	0·1
Ceded Dists.	Kurnool	1·6	+1·3	1·9
	Nandyal *	0·4	+0·1	0·4
	Anantapur	...	- 0·1	0·1
	Hagari *	0·1	...	0·3
	Bellary	0·3	+0·1	0·3
	Cuddapah	...	- 0·2	...
Carnatic	Nellore	...	- 0·2	...
	Madras	3·4	+3·0	3·4
	Pallakuppam *	6·9	+5·8	7·1
	Palur *	12·4	...	12·4
	Cuddalore	11·9	+11·7	11·9
Central	Vellore	1.0	+0·8	1·0
	Salem	0·8	+0·3	0·8
	Hosur Cattle Farm *	1·1	+0·7	1·1
	Coimbatore	0·1	- 0·4	0·1
	Coimbatore Res. Inst. *	0·2	- 0·9	0·2
	Trichinopoly	0·6	+0·3	0·6
South	Negapatam	4·3	+4·0	4·3
	Aduthurai *	1·8	+0·5	2·6
	Madura	0·1	- 0·6	0·1
	Pamban	1·2	- 0·7	3·3
	Palamkottah	0·2	- 1·1	1·3
	Koilpatti *	0·3	- 0.4	0·3
West Coast	Trivandrum	0·4	- 1·1	0·4
	Cochin	1·4	- 0·5	2·4
	Pattambi *	0·2	- 0·2	0·2
	Calicut	0·9	+0·3	0·9
	Taliparamba *	0·4	...	0·4
	Nileshwar *	...	- 0·4	...
	Kasargode *	0·2	- 0·3	0·2
	Mangalore	...	- 0·1	...
Mysore and Coorg	Chitaldrug	0·5	+0·2	0·8
	Bangalore	...	- 0·6	0·3
	Mysore	0·4	+0·1	0·8
	Mercara	1·4	+0·8	1·4
Hills.	Kodaikanal	1·7	- 1·3	3·1
	Coonoor	2·8	+0·3	5·5
	Kallar *	2·7	+0·6	6·2
	Ootacamund *	1·6	+0·9	1·9
	Nanjanad *	1·9	+1·1	2·1

Stations marked * are stations of the Agricultural Dept.

Summary of general weather conditions: The weather over the whole of the area was generally fine till the 12th, when an area of low pressure extended westwards over the Bay and gave rise to general rain over the south of the peninsula and very heavy falls in the neighbourhood of Cuddalore on the 12th and 13th. Thereafter weather was normal with scattered thunderstorms in the Deccan, Central districts and West Coast. Rainfall was in excess along the south Coromandel coast, and locally in Coorg and the Deccan. The chief falls of rain were: Cuddalore 4·6" and Negapatam 3·4" (12th); and Cuddalore 7·2" (13th) Temperature was generally normal, Cuddapah reported the highest temperature of 105° on the 25th.

Weather Report for the Research Institute Observatory :

Report No. 3/33.

Absolute Maximum in shade	...	99·0°
Absolute Minimum in shade	...	60·5°
Mean Maximum in shade	...	95·2°
Departure from normal	...	+ 0·7°
Mean Minimum in shade	...	69·0°
Departure from normal	...	- 0·7°
Total rainfall	...	0·17″
Departure from normal	...	- 0·90″
No. of rainy days	...	1
Mean daily wind velocity	...	1·7 M. P. H.
Departure from normal	...	- 1·6 M. P. H.
Mean humidity at 8 hrs.	...	68·7%
Departure from normal	...	- 1·0%
Total hours of bright sunshine	...	295·2
Mean daily hours of bright sunshine		9·5

Summary of weather conditions : Weather was fine and dry during the greater part of the month except during the 12th and 13th when the unsettled conditions of the Coromandel coast induced a temporary revival of North-east monsoon conditions, accompanied with cool weather and cloudy skies. Temperature was below normal during the first half of the month and above normal in the latter half when the maximum rose to 99·0°. Rainfall was below normal and one fall of 0·17 inch was recorded.

Weather Review (APRIL—1933)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	1·4	+0·6	1 9
	Berhampore *	1·7	+0·4	2·3
	Calingapatam	0·4	−0·5	0·5
	Vizagapatam	0·1	- 0·7	0·6
	Anakapalli *	3·5	+2·2	3·8
	Samalkota *	0·4	−0·2	0·8
	Cocanada	0·2	−0·4	0 6
	Maruteru *	...	...	...(a)
	Masulipatam	0·1	−0·5	0·1
	Guntur *	...	...	...(a)
Ceded Dists.	Kurnool	1·0	+0·5	3·6
	Nandyal *	0·1	−0·2	0·5
	Bellary	1·5	+0·7	1·7
	Hagari *	0·4	+0·2	0·7
	Cuddapah	0·1	- 0·3	0·1
	Anantapur	0·9	...	1·1
Carnatic	Nellore	...	−0·4	...
	Madras.	...	−0·5	3 5
	Pallakuppam *	...	−1·4	7·1
	Palur *	...	?	12·4
	Cuddalore	0·1	- 0·5	12·0
Central	Vellore	0.3	−0·3	1·3
	Salem	1·3	−0·5	2·1
	Hosur Cattle Farm *	...	...	...(a)
	Coimbatore	2·6	+1·2	2·7
	Coimbatore Res. Inst. *	3·7	+1·6	3·9
	Trichinopoly	1·9	+0·2	2·6
South	Negapatam	0·3	−0·3	6·3
	Aduthurai *	0·3	−0·7	2·8
	Madura	3·3	+1·3	3·3
	Pamban	0·1	−1·5	3·4
	Koilpatti *	2·5	+0·5	2·8
	Palamkottah	5·3	+2.8	6·6
West Coast	Trivandrum	5·7	+1·2	6·2
	Cochin	8·1	+3·4	10·5
	Pattambi *	4·3	+0·9	4·5
	Calicut	10·0	+6·7	10·9
	Taliparamba *	3·7	+1 0	4·1
	Nileshwar *	2·3	+0·9	2·3
	Kasargode *	6·2	+3·8	6·4
	Mangalore	2·7	+1·7	3·4
Mysore and Coorg	Chitaldrug	2·6	+1·4	3·4
	Bangalore	0 9	−0·4	1·3
	Mysore	2·5	+0·1	3·2
	Mercara	1·7	−1·0	3·1
Hills.	Kodaikanal	6·6	+2·3	9·6
	Coonoor	4·4	+0·1	10·0
	Kallar *	3·8	+1·1	10·4
	Nanjanad *	2·6	−0·7	4·8
	Ootacamund *	1·9	−1·2	3·8

* Stations of the Agricultural Dept.

(a) Reports not received.

Summary of general weather conditions: The weather at the beginning of the month was fine with a few scattered thunderstorms in the west of the peninsula, and high temperatures in the Deccan. On the 9th thunderstorms became general over the south of the peninsula and continued till the 13th, and some heavy falls were reported from the west coast, and a few scattered falls also occured on the North Madras Coast. A low pressure area appeared over Mysore and Deccan on the 17th but became unimportant on the next day after giving a few scattered hundershowers in the area. On the 24th conditions became unsettled over the central regions of the Bay but moving eastwards did not influence the weather to any great extent. Scattered thunderstorms continued till the end of the month.

Rainfall was general over the whole area with the exception of the Carnatic, and was in excess generally over Malabar, and Mysore, and locally in the Central districts, Circars extreme south and Deccan. The chief falls recorded were: Calicut 4·4" and Cochin 3·2" on the 11th.

Temperature fluctuations were irregular and connected with the distribution of the rainfall, and day temperatures were generally below normal. Cuddapah reported a maximum of 107° on the 8th and 29th.

Weather Report for the Research Institute Observatory:

Report No. 4/33.

Absolute Maximum in shade	99·5°
Absolute Minimum in shade	67·5°
Mean Maximum in shade	95·5°
Departure from normal	– 0·1°
Mean Minimum in shade	73·2°
Departure from normal	+ 0·2°
Total rainfall for month	3·65"
Departure from normal	+ 1·61"
Heaviest fall in 24 hrs.	1·32"
No. of rainy days	4
Mean daily wind velocity	1·9 M. P. H.
Departure from normal	– 1·5 M. P. H.
Mean humidity at 8 hrs.	73·0%
Departure from normal	+ 3·0%
Total hours of bright sunshine	268·8
Mean daily hours of bright sunshine	9·0

General weather conditions: The weather was fine during the first week of the month with high day temperatures. Thunderstorms appeared on the 8th and lightning or thunder was recorded almost daily thereafter till the end of the month. The observatory recorded two very severe thunderstorms on the nights of the 24th—25th and 26th—27th, accompanied by severe squalls and continuous lightning and thunder. The second storm was of exceptional intensity, though the rainfall which accompanied it was local in character, decreasing rapidly to the south-east, it was 1·32" at the Observatory, 1·59" at a gauge 4 furlongs to the N. W., and 0·7" at Coimbatore Town about 3 miles to the S. E.

Rainfall was in large excess, and wind velocity below normal. Other climatic elements were nearly normal.

P. V. R. and T. S. L.

College News & Notes.

Results of the B. Sc. Ag. Degree Examination 1933: The following is the list of successful candidates in the recent B. Sc. examination :—

First Examination: (New Regulations): S. Arunachalam; M. Balakrishnan Nair; C. Bhujanga Rao; J. Gopala Rao; P. Govinda Rao; P. Kameswara Rao; S. Kanakaraj David; M. Kasiviswanadhan; C. P. Kesavan Nair; N. Krishna Marar; S. Kutti Mudali; K. Lakshmanan; N. Mariakulandai; Moncy Joseph; G. Murugesan; G. Narasimha Murti; U. Narasinga Rao; V. Narayana Pillai; N. Raghava Rao; T. S. Ramakrishnan; B. V. S. Ramalingaswami; V Sadasiva Ayyar; Samuel Joshua; D. Satyanarayana; M. Satyanarayana Rao; S. Satyanarayanamurthi; R. Soundararajan; P. Srinivasan; R. Sriraman; B. Suryanarayanamurti; M. Venkataramayya; N. Venkata Rao.

Part I. (Old Regulations): S. Adinarayanamurti; R. Alagiamanavalan; U. Ananda; P. S. Anantanarayanan; C. Balasubramanian; Bennet P. Masilamani;

K. V. Chelapathi Rao; M. R. Devarajan; M. Edwin Amritharaj; K. V. Cauranga-murthi; C. K. Gopalakrishnan; V. Jayaraman; M. Kandaswami; C. Krishnamurti; K Krishnamurti; M. Lakshmikanthan; K. Minakshisundaram; S. Muthuswami; C. Parthasarathi; S. V. Parthasarathi; G. Radhakantam; P. Rama Rao; B. Ramakrishna Reddi; K. V. Reddi Naidu; P. C. Sahadevan; G. Satyanarayana Rao; P. Seetaramiah; V. Srinivasan; M. Srinivasa Rao; R. Subbiah; A. Subrahmanyam; Tayi Ramanujulu; Y. Veeriah; G. Venkataratnam; G. Venkatasastry; K. Viswanadham; P. S. Viswanathan.

The following have passed part I with reference in subjects noted against each:— G. Doraiswami (Chemistry); P. K. Kunhi Anujan Raja (Engineering); G. Satyanarayana (Engineering); C. Vadamalai (Chemistry); P. Hanumantha Reddi (Chemistry).

Part II. (Old Regulations): K. Adhinarayana Rao; M. Bhavani Sankar Rao; T. S. Dakshinamurthi; F. L. Daniel; T. Devasikhamani; D. T. Dhanapandian; C. Ekambaram; S. Gideon Ayyadurai; P. Gopalakrishnan; D. C. Hanumantha Rao; C. Konda Reddi; K. M. Krishna Menon; N. S. H. V. Krishnamurthi; T. E. Krishnaswami; S Lakshmanan; G. Mahadevan; Muhammad Abdul Jaleel; Muhammad Obedullah Shah; K. R. Nagarajan; K. M. Narayanan; Y. V. Narayanayya; B. W. X. Ponnayya; K. Raghunatha Reddi; R. Rajeswara Gupta; M. Rama Reddi; J. P. V. Ranga Rao; K. V. S. Satyanarayana; T. V. Seshadri Ayyangar; M. Sitaramaraju; D. Srinivasa Rao; V. S. Rangacharlu; N. Srirama Reddi; M. Subba Reddi; K. Sundararajan; W. Thirumala Rao; S. Varadarajan; K. Venkataswami; Y. Venkataswami; C. Venkatamuniappa Chetti; T. Venkatarama Reddi Anantaram Panda; A V. Purushothamarcharyulu; C. Lakshmanacharya; U. Seshagiri Rao; T. S. Jagannathan; P. Parthasarathi; R. Guruswami; Kerala Varma.

Scientific Honours for Departmental Officers: Mr. K. Cherian Jacob of the Botany Section and a member of the Union has been admitted as a Fellow of the Linnean Society of London. We also understand that Mr. T. D. Iswara Ayyar of the Simms' Park, Coonoor, has been made a Fellow of the Royal Horticultural Society, and that Mr. P. Satyanarayana of the Chemistry Section has been awarded the M. Sc. Degree of the Madras University for a thesis on "The Chemistry of Bordeaux Mixture."

Indian Officers' Association: Mr. C. V. Seshachari, Manager of the Central Farm, was given a hearty 'send off' by the members of the Agricultural Section of the Association on the eve of his departure on promotion as Assistant Director of Agriculture, Madura.

The Fieldmen Association: The Annual General Body Meeting of the Association came off on 11—5—33 when the Annual Report showing the steady progress of the Association was presented at the meeting. The following office bearers were elected for the coming year:—*President:* Dr. J. S. Patel; *Secretary:* Mr. S. Kalayanasubrahmanyam; (Mycology); *Asst. Secretary:* Mr. K. Raghavan (T. C. C.); *Managing Committee Members:*—Messrs. B. Rangiah Pillai (Entomology); P. N. Kader Batcha Sahib (Cotton); S. Srinivasan (Millet) and J. Manuel (Paddy)

The Coimbatore Collector's Durbar: The Collector of Coimbatore held a Durbar on 11—5—33 to present the Sanads and Insignia to the recipients of the New Year Honours in Coimbatore, among whom M. R. Ry. Rao Bahadur C. Tadulinga Mudaliar was one. A large gathering of officials and non-officials from the town and from our estate attended the function to witness our Principal being presented with the Sanad and the Insignia.

Scout Activities: The Scouts of the Estate Troop spent a two days' delightful camp at Kuniamuthur, where comfortable arrangements were made for them, through the kind exertions of Mr. Marudachalam, Fieldman to the Government Mycologist.

Visitors: Mr. T. K. Chidambaranatha Mudaliar, who as Commissioner of the Religious Endowment Board stayed at Coimbatore during the month, paid a visit to the College.

The College Band: The following is the full text of the song: "The College Band," sung by the students, on the occasion of the Students' Club Day, in March last.

OUR COLLEGE BAND

A College Band — From far and near
We meet to learn — Our lessons here
To read her word — Whose every line
Is filled with hope — And joy sublime.

Chorus:—

May our Endeavour Band
Now gathered in her name
United heart and hand
Go forth to spread her fame.
Then firmly let us stand
For God and Native land
And pray that He may bless
And keep our College Band.

The Agricol—With fields and all
Splendid labs—And superb staff
Coaches all—In useful science
And makes us all—A man to be.

Our object is—To help the poor
To help the ryot—Our Indian ryot
Whose work it is—To till the land
And grow the crops—To feed us all.

Oh may our Lord—Do help us all
To do His work—To hear his call
In private work—Or Government jobs
To follow him—In every way

Departmental Notifications.

I Circle. U. Vittal Rao, F. M. Smalkota, l. a. p. for two months from 1—5—'33 **II Circle.** R. Krishnamurty, Cotton Assistant, l. a. p. for 2 days on 20th and 21st April. V. Ratnaji Rao, A. D. Nayudupet, l. a. p. for 25 days from 7—5—'33. **III Circle.** P. Subrahmaniam, A. D. Siruguppa, extension of l. a. p. for 2 weeks on m. c. in continuation of leave from 15—2—'33. P. V. Subba Rao transferred to Nandyal. K. Jaganatha Rao, A. D. Anantapur, l. a. p. for one month and 11 days from 20—4—'33 with permission to avail Easter Holidays. **IV Circle.** A. Ramaswami Iyer A. D. Villupuram, extension of l. a. p. on m. c. for 2 months in con.-

tinuation from 3—5—'33. R. Narasimhachary A. A. D. extension of l. a. p. for 18 days from 13—4—'33. N. Krishna Pillai A. D. Tiruvettipuram l. a. p. for one month from 20—4—33. **Transfers.** S. Ramachandran on relief by Muhamad Abbas to Villupuram. M. Eggiyaswami as A. D. to Tindivanam. P. S. Venkatasubramaniam as F. M. to Palakuppam. K. P. Sankunni Menon F. M. posted to be Assistant to F. M. Palur. K. V. Natesa Iyer A. D. Cuddalore to Tiruvellore as additional Demonstrator to take part in the rural reconstruction work. **V Circle.** N. Subrahmania Iyer A. D. Trichy, l. a. p. for 2 months from 24—4—33. **VI Circle. Transfers.** P. K. Natesan F. M., A. R. S. Koilpatty, as A. D. Srivilliputhore. V. G. Dhanakoti Raju A. D. to Satur. S. Bhima Raju A. A. D. to Tinnevelly. L. Sankarkumar Pillai A. D. to Melur. G. Venkatakrishnan A. D. to Madura. G. J. Balraj F. M. Koilpatty l. a. p. for one month on m. c. from 6—4—'33. K. Krishnan A. D. Tinnevelly to Koilpatty as F. M. temporarily. V. Chidambaram Pillai A. D. Srivaikuntam will be in additional charge of Tinnevelly circle. **VII Circle.** A. Gopalan Nair, F. M. Taliparamba extension of l. a. p. for 2 months from 3—5—'33 on m. c. K. Achuta Nambiar A. A. D., l. a. p. for 15 days in continuation of the Easter holidays. **VIII Circle. Transfers.** M. Gopala Chetty A. D. Trichengode to be A. D. Hosur. T. S. Sundaram A. D. Hosur to be A. D. Salem. G. K. Subrahmania Iyer A. A. D. Salem to Krishnagiri. K. M. Venkatachalam Pillai A. A. D. Krishnagiri to Tiruchengode. K. H. Subrahmania Iyer A. D. Palladam l. a. p. for one month and 15 days from 27—3—'33 on m. c. On return from leave he is posted to Annur. A. K. Ramasubba Iyer A. D. Annur to Udamalpet. T. K. Thangavelu to Gobichettipalayam. K. Kuppamuthu is posted to work under A. D. Erode. **D. D. L. S.** H. Narahari Rao F. M. l. a. p. for one month and 13 days from 8—5—'33. **Cotton Section.** R. Sankara Iyer Assistant l. a. p. for 28 days from 26—4—'33. **Curator's Section.** P. Govindakutty Kurup F. M. Kallar and Barliar Gardens, l. a. p. for 3 weeks from 24—4—'33. **Paddy Section.** M. K. Padmanabhan Assistant, l. a. p. for 15 days from 1—5—'33. V. M. Ramunni Kidavu F. M. Pattambi, l. a. p. for 15 days from 24—4—33. **O. S. S's. Section.** C. M. John, Senior Assistant, Palakuppam, l. a. p. for one month and 18 days from 22—5—'33. **Principal's Office,** Francis Joseph l. a. p. for one month and three days from 12—5—33. K. K. Raghavan F. M., l. a. p. for one month and 12 days from 20—4—'33. **D. A's. Office orders. Transfers.** G. J. Balraj A. F. M. Koilpatty to be A. A. D. Mannargudi. S. P. Fernando, A. A. D. Mannargudi to be A. F. M. Koilpatty. K. P. Sankunni Menon F. M. Oil Seeds Specialist's Section to iv circle. K. V. Natesa Iyer A. D. Cuddalore to Tiruvellore to work in the rural reconstruction scheme. P. S. Venkatasubrahmaniam to Palakuppam. M. Eggiaswami Iyer F. M. to Palur. S. Ramaswami Iyer A. D Udamalpet to A. R. S. Anakapalle to be Botany Assistant Temporarily. R. Vasudeva Rao Naidu F M. Maruteru to be F. M Anakapalle. K. Kuppamuthu appointed to officiate as upper subordinate Agricultural Section in the iii grade on Rs. 75/- and to report for duty to D. D. viii circle. R. Govindaramayya A. D. Musiri, to iii circle Bellary. P. S. Athmarama Iyer A. D. Kumbakonam to iii circle to report for duty to D. D. iii circle Bellary. V K. Appaji offg F. M. Kalahasti to v circle. Dr. C. J. George. Entomology Assistant extension of leave without allowances for 4 days from 18—4—'33. P. S. Narayanaswami whose officiating appointment as Assistant in the Entomology section terminated on 21st April 1933, will be considered to have been officiating as Assistant in the Entomology section from 22nd April 1933 up to 19th June 1933. K. Veerabhadra Rao Offg. Assistant, Chemistry Section Coimbatore to the A. R. S. Anakapalle. T. Varahalu, Chemistry Assistant. Anakapalle to Coimbatore.

UNIVERSITY OF MADRAS

B. Sc. Ag. Degree Examination Question Papers 1933.

(New Regulations)

FIRST EXAMINATION

1. AGRICULTURE

(Monday, 3rd April 7 A. M. to 10 A. M.)

Only six questions are to be answered. Questions 5 and 7 are compulsory.

1. Discuss the necessity for deep cultivation on heavy black soils.

2. (*a*) Illustrate the type of tine you would expect to find on (i) a grubber, (ii) a cultivator, (iii) a harrow.

(*b*) What shape of plough mouldboard would you use in (i) a sticky clay soil, (ii) a sandy soil ?

3. Sketch a section through (*a*) a threshing machine, and (*b*) a winnowing machine, and name the essential parts. Briefly indicate the use of each part.

4. State how air movements arise. What are the effects of the NE. monsoon on dry and garden-land farming in the Coimbatore district ?

5. Describe how you would effectively incorporate the following in a garden-land soil :—

(*a*) Five tons of farmyard manure per acre.

(*b*) A four-foot high green manure crop of 20,000 lb per acre

(*c*) A two-inch layer of tangled sugar-cane trash.

6. Describe the formation and the distinguishing features of a laterite soil.

7. What is the effect of 'aspect' on soil conditions ? Is the effect of 'aspect' greater in the plains or the hills ? Give reasons.

8. Enumerate the agencies which are responsible for the formation of (*a*) sedentary soils, and (*b*) alluvial soils, and briefly describe their action.

2. BOTANY

(Monday, 3rd April 1 P. M. to 4 P. M.)

Only six questions are to be answered. Questions 3 and 8 are compulsory,

1. What are the food substances commonly stored in seeds ? In what form do these occur and by what tests would you recognize them ?

2. Mention some of the modifications met with in the stems and roots of flowering plants, giving examples.

3. What is meant by 'secondary growth' and what is its significance ? Describe the process as it is seen in the dicotyledonous stem and root with illustrative sketches.

4. What is transpiration ? What parts of the plants are chiefly concerned in the process ?

5. Describe an experiment you have seen to show that light is necessary for the formation of starch.

6. What are the contrivances in flowers for cross fertilization ? Give examples.

7. Give a short account of the adaptations met with for dispersal of fruits and seeds in flowering plants, mentioning suitable examples.

8. What are the distinguishing characters of Amarantaceae and Euphorbiaceae ? Mention *two* plants of economic importance in each.

3. CHEMISTRY

(Tuesday, 4th April. 7 A. M. to 10 A. M.)

Only six questions are to be answered.

1. Give a brief account of the paraffins, their occurrence, chief properties, and commercial uses.

2. Describe how you would determine the molecular weight of a substance which can be vaporized without decomposition. Give experimental details.

3. State how you would prepare sulphuric ether, giving experimental details. What are the reactions involved when methyl-ethyl-ether is formed ?

4. How is ethyl alcohol prepared on a commercial scale ? What are its uses in science and industry ? What are its chief properties ?

5. State briefly arguments in favour of the constitutional formula for benzene.

6. How would you test for the following :—(*a*) nitrogen, (*b*) alcohols, (*c*) aldehydes, and (*d*) carbohydrates ?

7. What are the fatty acids ? Why are they so called ? What are their chief properties ?

8. How are the amino-acids derived ? What is their biochemical importance ?

4. ZOOLOGY

(Tuesday 4th April. 1 P. M. to 4 P. M.)

Only six questions are to be answered.

1. Describe the phenomenon of 'Alternation of Generations' in the animal kingdom.

2. Explain how a bird is adapted for aerial life, a fish for aquatic life, and a frog for amphibious life.

3. Describe the method of locomotion in (*a*) Amoeba, (*b*) Paramoecium, (*c*) Snail, (*d*) Earthworm, (*e*) Snake.

4. Describe the life-history of any *one* of the parasitic worms.

5. Describe the typical formation of the Gastrula. What is the biological significance of the Gastrula ?

6. What are the characteristics of mammals ? Name the chief mammals of economic importance.

7. Classify Insecta, stating the chief characteristics on which the classification is based.

8, Write notes on :—retrogressive metamorphosis, convergence, metameric segmentation, gene, nephridia.

(Old Regulations.)

PART I.

1. AGRICULTURAL ENGINEERING

(Monday, 3rd April. 7 A. M. to 10 A. M.)

Only six questions are to be answered. Question 1 is compulsory.

1. (*a*) It is intended to put up a verandah 8 ft. wide (calicut tiled) and having a rise of 3 ft, close to the wall of a main building, and have it supported at the outer end on teak posts 8 ft high and 8 ft. apart (centre to centre) carrying T. W. bressummer, and at the other end on corbel stones carrying a wall piece. The rafters are 2 ft. centre to centre and project 2 ft. beyond the posts. Determine suitable sections for rafters, bressummer, and posts. Assume wind-pressure 20 lb.

(b) Make a neat freehand sketch of the cross section of the above verandah, bringing out all the dimensions for the roof, floor, retaining wall, etc.

2 Give specifications for the following :—(*a*) plastering (new wall), (b) whitewashing (old wall), (*c*) painting (exterior doors and windows), (*d*) flooring of a granary.

3. (*a*) Describe, with sketches, the methods of scarfing ordinarily employed in a village smithy for making hoops out of flat-iron.

(*b*) How would you make and fit the hoop for a cart-wheel, 3 ft. 9 in. diameter, out of a long flat-iron bar 2¼ in. × $\frac{5}{16}$ in. ?

4. (*a*) Give the proportions of C. I. wheel teeth commonly adopted, for instance, in a bullock-driven sugar-cane crusher, clearly explaining backlash and clearance.

(*b*) Describe with sketches *either* the cutting arrangements provided in a mower, *or* the nozzle of a sprayer.

5. (*a*) Explain how a screw is only an adaptation of an inclined plane.

(*b*) A tractor weighing 3 tons is capable of pulling a wagon weighing 12 tons on a level road. Assuming the coefficient of traction to be 150 lb. per ton, what is the tractive force on the level road ? What load can it draw up an incline of 1 in 10 ?

6. (*a*) Show by means of a sketch how you would construct a Spanish module for obtaining a constant discharge of water from a canal having variable heads.

(*b*) Design a suitable plug for an orifice 16 inches in a Spanish module capable of discharging 5 cub. ft. per sec. the head varies from 5 ft. to 2 ft.

7. (*a*) State the laws of fluid friction.

(*b*) An irrigation canal in earth with side-slopes 1½ to 1 conveys 600 cub. ft. per sec. at a velocity of 2½ ft. per sec. Design a suitable canal section with a depth of 3 ft.

8. (*a*) Explain the term 'hydraulic gradient'.

(*b*) It is found that x gallons of water are discharged per minute through a certain pipe which is 1000 ft. long. What would be the discharge if the last 500 ft were provided with a second pipe, of the same diameter as the first and laid side by side with it, and the water is divided equally between the two pipes ?

Make a sketch to show the hydraulic gradient for both arrangements of the pipe line.

2. AGRICULTURAL BOTANY

(Monday, 3rd April. 1 P. M. to 4 P. M.)

Only six questions are to be answered. Question 8 is compulsory.

1. Write a brief account of the vascular bundle system of a dicotyledonous plant embracing (*a*) bundle structure, (*b*) distribution in the organs of the plant, and (*c*) functions.

2. What purposes are served by the intercellular spaces in plant tissues ? Illustrate your answer by reference to tissues in leaf, stem, and root

3. Give an account of the characteristics of Malvaceae and Solanaceae, and mention some plants of these families that are of economic importance.

4. What are the special botanical characteristics by which you distinguish the following families :— Myrtaceae, Rubiaceae, Rutaceae, and Gramineae ?

5. Draw floral diagrams of the following :— rice, tomato, daincha, plantain, coffee, and sunflower. Give their botanical names, and mention the families to which they belong.

6. Explain the following :—Pneumatophore, Perisperm, Nucellus, Synconium, Velamen, Caryopsis, Periblem, and Verticillaster.

7. Contrast the characters and methods of nutrition of parasitic and saprophytic plants, using members of these groups found in agriculture and horticulture to illustrate your answer.

8 What is considered to be the significance of the process of respiration to a plant ? Illustrate your answer by reference to (*a*) the germination of seeds, (*b*) the cambium layer of a woody plant, and (*c*) stored fruit.

3. AGRICULTURAL CHEMISTRY

(Tuesday, 4th April. 7 A. M. to 10 A. M.)

Only six questions are to be answered. Question 7 is compulsory.

1. Explain what you understand by 'alcoholic fermentation'. Give the important properties and reactions of ethyl alcohol.

2. What do you understand by (a) constitutional formulae, (b) polymerism, (c) unsaturated fatty acids, (d) essential oils, and (e) glucosides? Give *one* example of each.

3. Compare and contrast the properties of the aromatic and fatty acids, taking benzoic and acetic acids as the representatives of their classes.

4. How is potassium ferrocyanide prepared commercially? How would you prepare from it a pure specimen of (a) potassium ferricyanide, and (b) urea?

5. Explain what you understand by 'wilting coefficient of soil'. In what respects does it differ from the 'hygroscopic coefficient'? How are these coefficients determined?

6. What is 'humus'? How is it determined? Give its properties and explain its importance in soils.

7. What are colloids? What colloids are present in soils? From the agricultural point of view how far are they advantageous in soils? When do they prove to be disadvantageous and why?

8. Presence of certain salts in soils is considered to be injurious to crops. Name these salts in the order of their harmful character. Discuss the conditions under which salt lands develop.

4. AGRICULTURAL ZOOLOGY

(Tuesday, 4th April. 1 P. M. to 4 P. M)

Only six questions are to be answered. Question 4 is compulsory.

1. Describe the embryonic development of any insect you have studied.

2. Describe in detail the anatomical changes undergone by a Dipterous larva during metamorphosis.

3. How do you distinguish (a) a Trichopterous adult from a moth, (b) a tadpole from a fish, (c) a round worm from a tapeworm, (d) an earthworm from a snake, (e) an Anopheles larva from a Culex?

4. What are the important insect pests of pulses in the Madras Presidency? Give an account of the methods adopted for their control.

5. Explain the action of the following insecticides:— (a) crude oil emulsion, (b) Shell tox, (c) tobacco decoction, (d) pyrethrum powder, (e) potassium cyanide.

6. State the nature of the measures now in existence to prevent the introduction of notorious insect pests into India from elsewhere. Discuss the adequacy of these measures.

7. Briefly describe the methods you would employ to eradicate Termites from a garden.

8. Describe the life-history of the pink boll worm, and indicate how the life-history differs from what is obtainable in other parts of the world. What reasons would you adduce for the difference?

5. AGRICULTURE. I

(Wednesday, 5th April 7 A. M. to 10 A. M.)

Only six questions are to be answered. Question 3 is compulsory.

1. What are the agricultural characteristics of a sandy soil? How will you rectify its defects? Explain why certain crops are not grown in them.

2. Enumerate the points that would help you to decide whether a Kangayam calf is fit for stud purposes. How would you feed it during the first year of its growth? What fees will you charge per service if the cost of its rearing and maintenance is to be covered by the service fees?

3. A farmer who has no experience of mhote working asks you to help him in the erection of a single mhote. Describe to him, giving suitable sketches wherever necessary, the method of erection, the nature of material used, the points he should be careful about, and the probable cost of each item of work.

4. Compare and contrast the work done by a country plough, a drill without the sowing arrangement, a Junior hoe, and an H. M. Guntaka. State under what conditions you will use them on black cotton soils.

5. Arrange the following crops in a rotation for garden lands, stating the months when they will be on the field:—chinnamanjal cholam, panivaragu, Cambodia cotton, tobacco, ragi, periamanjal cholam for fodder.

State under what conditions a farmer will be forced to deviate from the normal rotation practised in a tract.

6. Describe the methods which a farmer should adopt if he is to secure the maximum benefit of the rainfall of the tract.

7. Classify agriculturally the important weeds growing on the Central Farm. Describe the means you would adopt to control their spread, taking a good example from each class of weed.

8 A field is found to take an unusually long time to get to a ploughable condition after the rains. When it dries, it becomes very hard. What measures would you take to bring it to good heart? Estimate the cost of such measures per acre of this land.

6. AGRICULTRE. II

Including Animal Hygiene

(Wednesday, 5th April. 1 P. M. to 4 P. M.)

Only six *questions are to be answ red. Questions 1 and 2 are compulsory.*

1. Describe with the aid of a diagram the anatomy of the heart of the ox.

2. Describe foot-and-mouth disease as regards aetiology, mode of infection, animals susceptible, and symptoms. What measures would you adopt in dealing with an outbreak of the disease in a farm?

3. Describe the methods of immunization adopted in respect of any *two* of the following:—(*a*) rinderpest, (*b*) black-quarter, (*c*) haemorrhagic septicaemia. Explain the principles uuderlying the methods.

4. Detail with reasons the principles you would observe in the construction of a cattle shed to accommodate twenty cows.

5. Give the actions, uses, and doses of the following drugs in cattle:—(*a*) magnesium sulphate, (*b*) carbolic acid, (*c*) copper sulphate.

6. Describe how you would treat the following:—(*a*) red water, (*b*) sheep-pox, (*c*) dysentery.

7. Name any *two* common internal parasites affecting cattle. Describe them and state the symptoms they produce in cattle and the treatment you would adopt.

8. What are the signs of pregnancy in a cow? Explain how you would take care of her before and after parturition.

PART II.

1. AGRICULTURAL BOTANY, I.

(Friday, 7th April. 7 A.M. to 10 A.M.)

Only Five questions are to be answered.

1. Give an account of *two* of the Phanerogamous parasites you know, indicating the adaptations to their parasitic mode of life. Briefly describe how these parasites can be kept under control.

2. Describe the morphological and structural adaptations seen in plants growing under aquatic and xerophytic conditions, giving suitable examples

3. In what respect does a 'moss plant' differ from a fern in its life-history? Illustrate your answer with suitable sketches.

4. How do fungus diseases of crop plants get spread from one country to another? Describe the methods adopted to prevent such spread.

5. Give an account of the life-history of any *one* of the important fungus diseases of the palms of economic importance in South India. How is it kept under check?

6. Describe the symptoms of the Blast disease of Paddy (*Piricularia oryzae*). What measures can be taken to minimize the loss due to this disease?

7. Discuss the methods you would adopt with your knowledge of Agricultural Botany in improving the sugar-cane crop of this Presidency.

2. AGRICULTURAL BOTANY, II.

(Friday, 7th April. 1 P.M. to 4 P.M.)

Only Five questions are to be answered. Question 4 is compulsory.

1. Draw up a key for the identification by means of stem and foliage characters only of the various leguminosae grown as green manure crops in the Madras Presidency.

2. Give a botanical account of samai (*Panicum miliare*) with special reference to its habit, root system, structure of inflorescence and flower, and state how it differs from the other panicums of agricultural importance.

3. Describe the structure of th› flower and fruit, with an account of the pollination methods, of cotton, sunnhemp, panivaragu, and castor.

4. Explain the theoretical results which would be obtained from a cross between two pure line parents involving two pairs of characters both of which exhibit simple dominance. What would be the value to the plant breeder of a cross between any of the resulting forms and the 'pure recessive'?

5. (*a*) Explain the following terms:—pure line, mutation, linkage, and homozygous.

(*b*) Give a short account of reduction division of the nucleus and its bearing on heredity.

6. Describe the morphological and physiological changes which take place in (*a*) beans, and (*b*) castor seed during the process of germination. Describe tests or experiments which you would perform in support of your statements.

7. What do you understand by vegetative propagation? Give examples of farm crops reproduced in this way and discuss the methods of crop improvement adopted in these cases.

3. AGRICULTURAL CHEMISTRY, I

(Saturday, 8th April. 7. A. M. to 10 A. M.)

Only five *questions are to be answered.*

1. Define the term 'digestive coefficient'. What is the exact significance of the term in animal nutrition? How is it determined for a given food?

2. Two samples of groundnut cake are available on the market; their analysis and prices are given below. Which of them would you select as a concentrate for your cattle, and why?

	Sample A.	*Sample B.*
Protein	51·7%	12·5%
Oil	5·3%	9·2%
Acid value of oil as milligrams KOH	71·0	126·0
Price per ton	Rs. 100/-	Rs. 87/-

3. Give experimental details and rationale of the method for the estimation of crude fibre in a food stuff. How is crude fibre important to a farm animal?

4. Give a brief account of the changes food protein undergoes in the animal system.

5. What are 'feeding standards'? What are the approximate requirements according to well-known standards for (*a*) dairy cows giving 20 lb. milk, (*b*) working bullocks, (*c*) one year old calves?

6. What are the chief bacteria which occur in milk, and which make it a source of infection?

7. What are the functions of (*a*) protein, (*b*) fat, and (*c*) mineral matter in the nutrition of farm animals?

4. AGRICULTURAL CHEMISTRY, II.

(Saturday, 8th April. 1 P.M. to 4 P.M.)

Only Five questions are to be answered.

1 What is activated sludge? Explain the process by which it is prepared. How does activated sludge compare with (*a*) farm-yard manure, (*b*) oil-cakes as manure.

2. Compare sulphate of ammonia and nitrate of soda as fertilizers. What is their effect on soils?

3. How is superphosphate prepared? For what crops and for what soils is it useful? What is double superphosphate? Give the approximate percentage of soluble phosphoric acid in superphosphate and double superphosphate.

4. (*a*) State the chemical changes which take place during the assimilation of carbon by plants.

(*b*) How do non-chlorophyll plants obtain their supply of energy?

5. (*a*) What important differences are there in the composition of cereal grains and pulse grains?

(*b*) How is starch prepared from rice on a large scale? Give the important commercial uses of starch.

6. (*a*) What is the percentage of sucrose and glucose in the juice of well-ripened sugar-cane? What is the effect of lodging on the composition of the cane?

(*b*) Give the tests by which you would judge whether the sugar-cane is ready for harvest.

7. What are enzymes? What are their functions? How are they extracted and preserved? How are they named? Mention any *two* enzymes from plant bodies and any *two* from animal bodies, stating their function.

5. AGRICULTURE, I.

(Monday, 10th April. 7 A.M. to 10 A.M.)

(*Only Five questions are to be answered*).

1. Give the composition of good farm-yard manure. Out of the list of fertilizers given below select the cheapest and make up a mixture to give the N, P_2O_5, and K_2O equivalent of 10,000 lb. farm-yard manure.

Sulphate of ammonia	20·5 % N	Rs. 120 per ton.
Calcium cyanamide	19·5 % N	Rs. 150 ,,
Superphosphate	18·0 % P_2O_5	Rs. 110 ,,
Concentrated superphosphate	42·0 % P_2O_5	Rs. 150 ,,
Muriate of potash	50·0 % K_2O	Rs. 115 ,,
Sulphate of potash	48·0 % K_2O	Rs. 145 ,,

2. Describe the usual method of raising and curing a crop of chewing tobacco in Coimbatore. Detail the production expenditure per acre and show the probable profit.

3. What methods would you follow and what practices would you observe in the production of clean milk (cows') of high fat content?

4. Discuss the advantages and disadvantages to the landowner and tenant of a produce rent system as against a cash rent system.

5. Describe the most suitable type of silo for South Indian conditions. How would you fill it with a crop of fodder cholam and what precautions would you take?

6. State the method you would adopt to renovate a ten-year-old pasture of *kolukattai* grass and detail the cost.

7. Explain the following terms and briefly indicate their importance in agriculture:—

(*a*) Law of diminishing returns. (*b*) Satiability. (*c*) Insurance. (*d*) Maintenance farming. (*e*) Dual-purpose cattle.

6. AGRICULTURE, II

(Monday, 10th April. 1 P. M. to 4 P. M.)

(Only five questions are to be answered.)

1. Comment on the variations in the following agricultural practices :—

(*a*) A black-soil ryot of Bellary cleans his field of hariyali with a guddali, while his Coimbatore brother digs it out with a crowbar.

(*b*) Cotton is drilled in the Ceded districts, but it is broadcasted in Tinnevelly.

(*c*) The sizes of paddy fields and bunds in Coimbatore district are different from those observed in the Tanjore district.

(*d*) Cholam sowing preceeds cotton in Tinnevelly, while it follows cotton in Bellary district.

(*e*) A South-Arcot farmer lifts his water with a circular mhote, while in Coimbatore it is done with a single mhote and in Bellary with a double mhote.

2. What do you understand by the term 'standard deviation'? The following are the recorded yields of three strains under comparative trials.—

A	B	C
10·5	9·0	12·4
8·6	10·2	11·5
10·2	8·7	11·8
10·4	10·8	10·7
9·8	11·3	10·2
11·2	10·6	9·9

Determine the highest yielder, and state if it is significantly superior to the other two,

3. The two important features in the agricultural situation of to-day are comparatively high wages of labour and low prices of agricultural produce. Discuss briefly how you will make the cultivation on wet, garden, and dry lands pay in these circumstances.

4. Discuss the factors that determine the spacing given to crops. Illustrate each of them with a practice obtaining in this presidency.

5. There are 150 buffaloes and 60 cows in the village of Vellaikinar. Of these two-thirds are always in milk, and 120 persons are engaged daily in vending dairy products of this village at Coimbatore. State how you will organize and equip them so as to get more profit. Prepare a balance sheet for the first half-year.

6. Outline the steps you would take to obtain the maximum yield in a crop of Cambodia cotton. Make out an estimate for producing one pothi of kapas.

7. Under what conditions will you include market gardening in arable farming? State how this inclusion will affect your general farming.

7. AGRICULTURAL ESSAY

(Tuesday, 11th April. 7 A.M. to 10 A.M.)

Either, Discuss the organization of the production and marketing of grain grown on half a million acres of new grain-producing land recently settled by good farmers lacking in working capital. No rotation crops should be introduced.

Or, Discuss the effects of adulteration and mixing up of agricultural produce on the income derived by the farmer, and suggest measures by which the situation may be improved.

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UTILISATION OF FARM WASTES *

BY K. S. VISWANADHA AYYAR,

Assistant Agricultural Chemist, Agricultural College, Coimbatore.

Recent investigations at Coimbatore on the effects of manuring a crop on the nutritive and reproductive capacity of the resulting seed, have clearly impressed the necessity for the supply of organic matter to the soil in order to produce food stuffs well supplied with nutrients for the proper nourishment of both man and animal. It is an established fact that the organic matter in the form of humus plays the most important role in the upkeep of soil fertility as well as in the maintenance of ideal texture of the soil necessary for the growth of crops. Apart from this, the demand on the soil for increasing the out-turn from crops to meet the needs of the growing population, have necessitated the augmentation of the manurial resources for crop production. The alarming rate at which the organic matter of the soil is depleted and the urgency for making good the loss, as revealed by the soil surveys conducted in India, make it all the more imperative to supply this want immediately.

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* Paper contributed to a "Symposium on the Utilisation of waste Products" on 7th October 1932, at the Agricultural College, Coimbatore. An abstract appeared in the November 1932 issue of the M. A. J.

Till recently, the time-honoured farmyard manure, leaf compost, oil cakes and similar materials formed the main sources for the supply of organic matter to the soil. A survey of the amount of the available materials in conjuction with the needs of the area under cultivation, will at once impress the inadequacy of the present supply, which is about 1/20 of the demand. The available supplies of the organic manures being quite limited, means have to be found to tap other sources which can be made to yield manures as good as farmyard manure.

The need for organic manures being universally recognised, this problem of augmenting the supply has naturally attracted the attention of scientists. At Rothamsted, Richards and Hutchison sought to remedy this deficiency by finding a suitable substitute for farmyard manure. They were the pioneers in this direction who realised quite well the gravity of the situation and the demands of the future and succeeded in solving this problem. In their search, they pitched upon waste organic matter of low manurial value which could easily be worked up, by the addition of some fertilising material, to the standard and quality of farmyard manure, in its fertilising value. Wheat straw was used as the basic material with ammonium sulphate as a quick-acting nitrogen starter to hasten the decomposition of the stuff with the result that the fermented manure resembled farmyard manure in appearance, consistency and manurial value. This process was styled as the manufacture of 'synthetic farmyard manure' in contradistinction to the natural farmyard manure. Concentrated starters were put on the market with the patented names of "Adco" accelerator and "Adco" complete manure, with full directions for their use.

Simultaneously, Hutchison in India, started the study of fermentation of green manure using sunnhemp as his material and obtained an odorless product of high manurial value using copper sulphate—potassium cyanide mixture as a deodoriser. Besides, he also demonstrated the superiority of the fermented product to the unfermented. It was established that fermentation of the material was indispensable before application as manure.

Fowler working on the activated sludge system of sewage disposal, has demonstrated a process of converting night soil into an inoccuous and useful fertiliser, fit for application to crops. It was also shown that in this process nitrogen losses were greatly minimised by its conservation in the resulting product. Besides, the activated sludge was found to be one of the best inocula containing bacteria capable of attacking the most resistant materials.

At the Department of Biochemistry, Bangalore, experiments have been conducted on the utilisation of waste, in the form of municipal rubbish, into a useful manure by introducing activated sludge as the inoculum for starting decomposition. Well-fermented organic manure has been obtained possessing high manurial value. In this process the presence of cellulose fermenters in activated sludge was availed of, to give the initial start.

Thus it will be seen that attempts have been made by numerous workers in the direction of utilisation of waste products to produce "wealth from waste" with great success.

Encouraged by the results obtained both at Rothamsted and at Pusa, a beginning was made in Madras in the year 1922, to tap the available sources of waste organic matter found in abundance, for the preparation of synthetic manure. Experiments were planned on the same lines as at Rothamsted but using 1500 lbs. of paddy straw and calcium cyanamide as basic material and starter respectively, instead of wheat straw and ammonium sulphate, proper moisture conditions being maintained for the rapid decomposition. A careful record of the temperature developed was maintained, the maximum temperature attained being 54° C, when the air temperature (in shade) was about 28° C.

It was observed that there was a quick rise in temperature within 24 hours and the heat, developed, naturally led to rapid decomposition of the material but, because of the method of heaping, there was uneven fermentation. The subsequent forking and mixing of the fermented material with the unfermented, resulted in uniform decomposition and there was a loss of 47 per cent. of organic matter and 14 per cent. of nitrogen. The manure was ready in 9 weeks.

Improvements were introduced to minimise the sudden rise of temperature and to regulate the maintenance of moisture conditions necessary for even decomposition. Experiments were started with *ragi* straw both under aerobic and semi-aerobic conditions, the latter condition being obtained by mud-plastering the exposed parts. The following results indicate clearly a reduced loss of nitrogen and organic matter under semi-aerobic conditions.

	Per cent loss of	
	Nitrogen.	Organic matter.
Aerobic	26·76	37 7
Semiaerobic	9·29	22 2

In the light of these observations, the following experiments were conducted in 1923 with *ragi* straw both in heaps and in pits and with various amounts of nitrogen. Nitrogen was added as ammonium sulphate or calcium cyanamide respectively at 0·75 per cent. and 0·5 per cent. calculated on dry matter. In the case of ammonium sulphate lime carbonate was also added to correct the acidity.

	Ammonium sulphate series.				Calcium cyanamide series.			
	Higher Nitrogen per cent of loss.		Lower Nitrogen per cent of loss.		Higher Nitrogen per cent of loss.		Lower Nitrogen per cent of loss.	
	N.	O. M.	N.	O. M.	N.	O. M.	N.	O. M.
Heap	40·09	43·59	29·02	46·45	25·68	36·34	33·46	38·00
Pit	34·66	33·30	26·46	23·85	22·99	29·63	15·83	27·00

(Note:— N. is Nitrogen. O. M. is Organic matter).

The loss of nitrogen from experiments in pits was less in every case than that from heaps. In pits it ranged from 16 to 34 per cent and in heaps, from 26 to 40 per cent. The high percentage of losses in all these experiments might have been due to the soaking of the liquid portion of the manure into the soil.

Apprehending the loss to be due to the exposed condition of the manure to the heat of the sun, a shelter was provided to the manure pits, but even then, the losses ranged from 44 to 55 per cent. These experiments have shown beyond doubt that the resulting loss under Indian conditions is due, chiefly to, too rapid decomposition at the initial stages and has been traced to the unsuitability to suit Indian conditions of the starters employed elsewhere. Naturally, attention was directed to the introduction of a suitable starter.

With this object in view, a detailed study of the " Adco " accelarator and " Adco " complete mixture was undertaken. These analysed with the following results :—

	" Adco " accelarator.	" Adco " complete mixture.
	%	%
* Loss on ignition	8·12	9·16
Insolubles	3·80	4·83
@ Solubles	88·08	86·01
Total.	100·00	100·00
* Nitrogen	2·91	6·63
@ Iron and alumina	11·90	3·92
Lime (Ca0)	42·90	46·50
Total Phosphoric acid	6·64	6·90
Potash	1·45	1·08

A bacteriological examination revealed the presence of active ammonifiers and nitrogen fixing organisms but cellulose organisms and nitrifiers were absent.

A synthetic mixture of calcium cyanamide, tricalcic phosphate and potassium sulphate were prepared resembling " Adco " and starters. This was compared with the "Adco" starters both on green and dry materials under laboratory conditions. The results are given below.—

Average of duplicates.

No.	Details of experiment.	Per cent loss of Nitrogen.	Per cent loss of dry matter.
	Air-dry Ragi straw: 1 kilo in each glazed pot.		
1.	Ragi straw only	1·28	69·67
2.	Ragi straw plus Adco mixture enough to supply 0·75% Nitrogen	34·05	64·90
3.	Ragi straw plus Nitrolim mixture made up in laboratory enough to supply 0·75% Nitrogen	23·60	64·5
	Ragi green: 1 kilo in each pot and "Adco" accelarator.		
1.	Control-ragi stems and leaves	12·16	54·6
2.	Green ragi straw plus Adco accelarator to supply 0·22% Nitrogen	29·01	50·8
3.	Green ragi straw plus Nitrolim mixture made upto supply 0·22% Nitrogen	26·56	48·57

Even though the fermentation was quite even in both cases, the loss of nitrogen occurred in both. But green materials do not require any nitrogen starter. The decomposition of the waste material was accelarated and this might be due to the stimulation of the organisms by the phosphate present in the starters.

Having partly succeeded to control the loss of nitrogen by the use of the quick acting starters of the nature employed so far, an attempt was made to introduce slow acting starters by using bonemeal and cattle dung in reasonable amounts so that the process might be slow and steady. Cane trash was tried in pits with these slow acting starters in suitable proportion. Results are given in the adjoining table.

Quick acting starters.		Slow acting starters.	
Percentage loss of			
Nitrogen	Organic matter	Nitrogen	Organic matter
34·05	64·9	15·1	69·4
33·6	64·5	3·6	53·0
33·0	60·3	5·2	55·0

This led to even decomposition resulting in a minimum loss of nitrogen. Thus under our Indian conditions the use of slow-acting starters appears to be more advantageous than the quick-acting starters of the "Adco" type.

In order to popularise the preparation and use of synthetic manure for crops and to study the rate of decomposition under varying climatic conditions prevailing in the different parts of this Presidency, as also with a variety of waste materials, demonstration experiments were started on the Government Farms, private estates and tea and coffee plantations. The results are summarised in the following table.

Results of analyses of Synthetic Farm Yard Manure obtained with different basic materials, calculated on moisture free basis.

Basic Material.	Nitrogen.	Phosphoric Acid.	Potash.	Remarks.
	%	%	%	Composition of farmyard manure. % Nitrogen 1·02. Phosphoric acid 0·63. Potash 1·76. Moisture in the final manure ranged from 50 to 70 %
1) Cumbu straw.	1·25	0·48	1·09	
2) Paddy straw.	1·60	0·16	1·93	
3) Guniea grass stubbles etc.	1·04	—	—	
4) Ragi straw.	1·43	—	—	
5) Dry weeds chiefly grass.	1·90	0·55	1·09	
6) Lantana leaves and stalks.	1·55	0·52	1·07	
7) Forest grass.	2·49	0·51	2·26	
8) Wild lemon grass:	1·93	0·24	0·90	
9) Lemon grass + lantana.	3.03	0·43	1·77	
10) Lemon grass only.	1·06	0·34	0·16	
11) Paddy straw.	1·59	1·34	3·37	
12) Cotton waste and groundnut husk.	1·62	1·04	1·25	

It will be seen that the composition of the resulting manure varies considerably depending upon the nature of the starting material and the time of the year in which the experiment is done. The combined action of dung and bonemeal was tested on highly resistant material such as cotton—stalks, etc., with success, but the time taken to ferment was six to eight months, whereas with other waste materials it ranged from three to five months. The manure retains fairly large amounts of moisture and has the texture and colour of farmyard manure. Cactus which possesses hard spines when subjected to this treatment shows considerable softening of the spines rendering the handling of the manure easy. The slow-acting nature of the starter introduced, has the additional advantage of maintaining a steady and even fermentation in the manure pits, without the danger of loss of the most valuable manurial ingredient—nitrogen. Hence it may be said that with high temperature conditions, prevailing in India, slow-acting starters are to be preferred.

Any waste organic material like weeds, leaves, coffee pulp, husks of grains, waste straws, stems of succulent and ligneous materials can be composted. Based on numerous trials conducted all over the Presidency with various materials ranging from easily decomposable to resistant, the following technique of manufacture has been evolved.

A pit of convenient size, 12 feet by 6 feet by 3 feet should be dug on high ground. The basic material is uniformly and loosely spread to a depth of 9 to 12 inches and water is evenly sprinkled till the whole material gets moist, every part of the heap being carefully watered so that no portion remains dry. This is the most important point to be remembered in the construction of the heap. Then 1 to 2 lbs of fine bonemeal are evenly broadcasted and over this an emulsion of 10 to 20 lbs of fresh cattle dung in 5 to 10 gallons of water is applied. A second layer of basic material is placed over this and treated similarly. The whole material is thus disposed of until a heap, about 2 feet high above the ground level is formed and then the top and the sides are mud-plastered. After the feremention has proceeded semiaerobically for four to six weeks depending on the nature of the material, the plaster is removed to permit aerobic fermentation If the heap has sunk unevenly, which is an indication of the defective fermentation the material is reheaped after forking in and proper moistening. The raw material is ordinarily decomposed in three to four months and is fit for application as manure. This is not too long a period seeing that no fresh inoculum is added, as is done by Fowler, nor great attention paid subsequent to the starting of the compost. By this process synthetic manure of normal composition as farmyard manure may be made at a cost of Rs. 3/- to 3½ per ton. From this we can easily judge that the synthetic farmyard manure. compares favourably with that of farmyard manure as regards the cost of production.

With synthetic manure thus prepared, field trials were conducted with the results recorded in following table.

Statement showing the yields of crops raised with organic compost as compared with Farmyard manure. Yields are for 5 cent. plots in lbs

Year	Crops	Grain			Straw			Remarks
		No manure	Organic compost	Farm-yard manure	No manure	Organic compost	Farm-yard manure	
1927—28	Chitarai Cholam Yellow	lbs. 88·4	lbs. 96 0	lbs. 90·4	lbs. 291·8	lbs. 303·0	lbs. 285·5	Manu-red
1928—29	Ragi	118 0	120·4	124·0	570·4	597·6	601·2	do.
1928—29	Chitarai Cholam	129 0	129 0	120·0	321·6	353·4	348·0	do.
1929—30	Cotton	338·1	369·2	371·3	...	...	...	Weight of kapp-as (residual effect)
1930—31	Ragi	125·0	141·0	139·5	228·0	290·0	232·0	Residual effect
1931—32	Chitarai Cholam	137·4	146·4	142·8	402·0	379·2	391·2	Manu-red.

The yields from synthetic farmyard manure plots were greater than those from unmanured plots and in some years were either equal to or slightly higher than, those of farmyard manure plots. The residual effects of the organic compost were more marked in some years than those of the farmyard manure. This clearly shows that the organic compost is as good as farmyard manure. An analysis of the crop—grain and straw—further showed, that the quality of the crop was as good as that of the crop raised with farmyard manure.

Even though by this process the majority of waste materials can be turned into a most useful manure there are certain limitations with such materials as night soil, wherein a process like this can only be applied with certain modifications. The process consists in pitting the night soil with rubbish and certain chemicals, which act as deodorisers and are non-toxic to plants when applied after fermentation. Fowler has recently recommended a method for using night soil as a starter in composting rubbish for conversion into a useful manure. This involves repeated exposure of the material with the night soil suspension on it, with the result that a manure of high value is obtained. But the sentimental objections to the handling of night soil and the cost of labour involved are two prime factors which are against the process, whereas the process developed here is without these drawbacks and the manure obtained compares favourably in composition and in cost of production with farmyard manure.

Experiments conducted here using various deodorising agents in composting night soil and the estate rubbish are sufficiently satisfactory and their results of analysis show that the process is a success as could be seen in the following table.

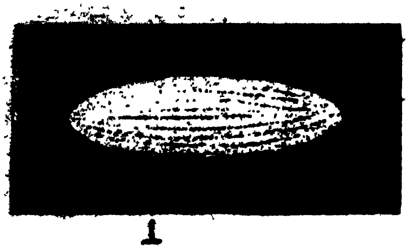
Results of analysis of 9 samples of poudrette for moisture and nitrogen (dry basis).

Original materials and treatment, if any.	Moisture. %	Nitrogen. %
1. 492 lbs. night soil plus 250 lbs. sweepings.	44·88	1·05 0·80
2. 480 lbs. night soil plus 500 lbs. sweepings, treated with 0·025% solution of $CuSO_4$	32·82	1·37 0·64
3. 420 lbs. night soil plus 500 lbs. sweepings treated with 0·025% solution of $CuSO_4$ dissolved in excess of KCN solution.	29·63	0·68 0 64
4. 524 lbs night soil plus 500 lbs. sweepings treated with Bordeaux mixture ($CuSO_4$ solution turned alkaline to litmus)	40·94	1·53 0·93
5. 532 lbs night soil plus 500 lbs. sweepings plus 5 lbs. common salt.	39 28	1·15 1·15
6. 1121 lbs. night soil alone.	69·87	1·91 1·47
7. 562 lbs. night soil plus 1000 lbs. sweepings.	29·66	0·79 0·55
8. 514 lbs. night soil plus 500 lbs. sweepings.	28·77	0·81 0·53
	40·27	1·29

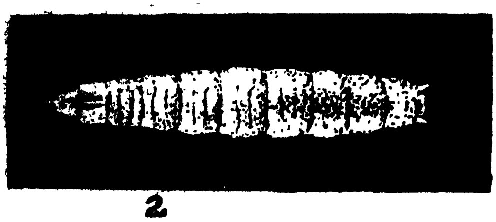
The observations so far recorded are so encouraging that it would be possible to produce manure out of wastes quite economically.

Summary. Results of experiments on the preparation of synthetic manure from organic wastes are discussed.

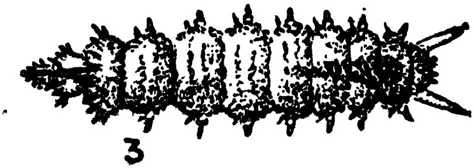
The losses of nitrogen and organic matter resulting from decomposition have been minimised by introducing semiaerobic conditions and slow-acting nitrogen starters such as bonemeal and cowdung-water.



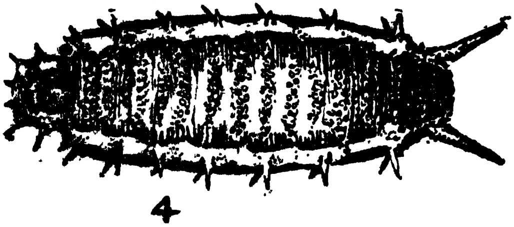
1. Egg



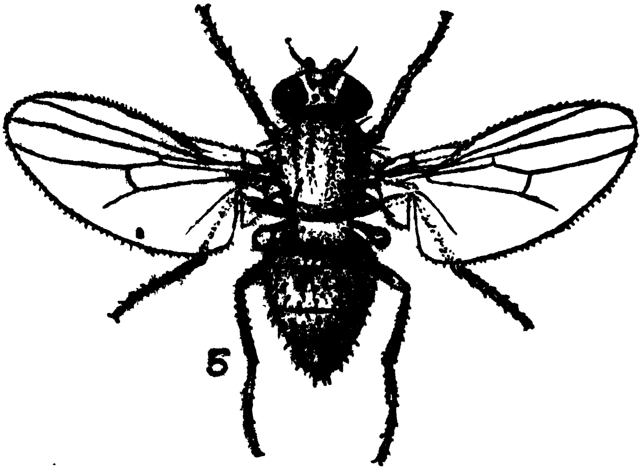
2. Newly hatched maggot



3. Full grown maggot.



4. Pupa.



5. Adult.

The " Adco " products are not suitable to our Indian climate and if used will result in serious loss of nitrogen. Analyses of organic compost obtained from various grades of [illegible] varying conditions are set forth and discussed. Based upon [illegible] gained, a working formula suitable for the production of [illegible]ts under Indian conditions is described.

The effect of compost thus prepared [illegible] over a series of years on crops against farmyard manure and the results of yields obtained are discussed.

The composition of the crops as regards [illegible] favourably with those raised with farmyard manure.

The economics of the process are laid down and the [illegible]cations necessary in handling night soil are indicated.

The results of field trials warrant the preparation and use of organic wastes profitably in the form of organic compost on an extensive scale.

AN AGROMYZID FLY PREDACEOUS ON APHIDS

BY Mr. M. C. CHERIAN, B.A., B.Sc., D.I.C.

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Introduction. This short note deals with the life history and habits of a beneficial insect, a fly* whose maggots are predaceous on Aphids (sucking insects)—one of the worst pests of cultivated crops. Along with Hover flies (*F. Syrphidae*), Lady-birds (*F. Coccinellidae*) and Lacewings (*F. Chrysopidae*) these fly maggots attack aphids on a large scale and destroy them in numbers. As this insect is one the farmer should be familiar with and protect as far as possible, a short description of its various stages is given below.

Life History. *Eggs* (Fig. 1) are laid singly by the female flies on plants infested with Aphids. These look like the Syrphid eggs being oval and white, but are smaller. These measure 0[illegible]6 m. m. in length while the Syrphid eggs are 0'8 m. m. long. Again the ridges found on the Leucopis eggs are longer than those of the Syrphid eggs. Also the Leucopis eggs have both ends more or less pointed while in the Syrphid eggs one end is slightly broader than the other. The egg period lasts two to four days.

Larvae. The newly hatched maggots (Fig. 2) which are about 0'45 m. m. long are pale white in colour. Unlike the young Syrphid maggots, hairs are absent on the body. Two short tubular out-growths from the dorsal aspect of the anal end directed backwards and outwards, which are the beginnings of the long larval respiratory processes of the mature maggot are dimly visible. The maggots soon after hatching feed on the Aphids by sucking out their body contents and begin to grow in size. They moult twice before pupation. In the mature maggots (Fig. 3) the pale white colour changes to that of yellow and the anal ' horns ' are longer* and more prominent, their tips being black. A detailed examination of the ' horns ' under the microscope reveals the prolongation of the lateral tracheal tubes into the horn like processes which end in three-branched claw-like structures. The full grown maggots are about 2·5 m. m. long. Before pupation the maggots exude a cement-like white fluid, probably for attachment, which hardens and turns black in colour in a couple of hours. The larval period lasts four to five days.

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* *Leucopis. sp.* Sub-family—Ochthiphidinae. Family—Agromyzidae.

Pupae. The pupae (Fig. 4) are dark brown in colour and look similar to the mature maggots but are more stumpy. These are about 2·2 m. m. long and 1 m. m. broad. In five to seven days the adults emerage by pushing their way out at the anterior end of the pupae.

Adults. Adult flies (Fig. 5) are very active creatures, short and stout and measure about 2 m. m. long. The general colour of the fly is greyish dark. Antennae including arista are dark and the halteres pale yellow. The abdomen is grey with a round black spot on each side of the median line of the second tergite. Legs are light dark. Adult flies have been noted feeding on the honey dew of Aphids A fly fed with jaggery water in captivity lived 21 days. The total life cycle lasts 11 to 16 days.

Hosts. Fly maggots have been observed feeding on Aphids on a variety of plants such as Cholam (*Sorghum*), Cotton (*Gossypium*), Cumbu (*Pennisetum typhoideum*) and beans (*Dolychos lab-lab*).

Parasites. A few *Chalcids* were once collected from a Leucopis pupa but in nature the number of such parasites seems to be very few.

GRAM WEIGHT IN RELATION TO POD AND SHOOT WEIGHTS IN BENGAL GRAM

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Introduction. In preliminary yield trials of crops the plant breeder has often to handle a large number of types although only a few of these can be carried forward. It is a practical consideration that the methods adopted at such a stage allow examination of as wide a range of material as possible with the minimum of labour and without loss of efficiency. Each crop sets its own problem in this connection.

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* Since sending to the press a few maggots with shorter respiratory horns, probably another species of *Leucopis*, have been collected feeding on Aphids and are under study.

In Bengal gram (*Cicer arietinum*) for instance, the actual determination of the yield requires the stripping and threshing of the pods and will take time and labour when the number of plants is large. Any method which will do away with much of this labour will be an improvement. Towards this end, other more easily determinable characters indicative of yield were investigated. The results of such a study are presented in this paper, from work done at the Nandyal Agricultural Research Station during the year 1932–33.

Material and methods. The material of the enquiry comprised 399 different cultures of Bengal gram grown along with 201 lines of local bulk in lines 1½ feet apart in the usual arrangement of raw yields, with a control line of local bulk coming between every two selections. Plants were spaced 9 inches apart in the lines each of which allowed for 26 plants excluding out-skirts. Each line of controls, as well as the selections was harvested separately and examined for the following characters.

(1) Shoot weight, (2) Pod weight and (3) Gram weight (weight of all plants correct to ¼ oz.) The shoot weight was the portion harvested by the sickle free of the roots.

Relations of the characters. For purposes of this study the gram weight was taken as the ultimate basis of yield, and, the extent to which the other two characters could be relied on as a measure of it was investigated. The co-efficients of correlation expressing the relations between the characters are given below :—

Table I.

Correlation of characters, pod weight, shoot weight and gram weight in Bengal gram.

Pairs of characters.	Local bulks (201)		Selections (399)	
	Correlation coefficient.	Partial correlation coefficient.	Correlation coefficient.	Partial correlation coefficient.
Grain weight and Shoot weight	0 938±0·006	0·444±0·037	0·926±0·005	0·387±0·029
Grain weight and pod weight	0·972±0 003	0·792±0·017	0·982±0·001	0·885±0·007
Shoot weight and pod weight	0·924±0·007	0·147±0·045	0·912±0·006	0·042±0·033

It is apparent that the characters form a very closely related group, the coefficient of correlation exceeding 0·9 in all cases. As the relationship is very high, it will be useful to evaluate the contributions of each character after eliminating the effects of the others. The partial correlation coefficients got in this way are given in columns (3) and (5). It is seen from these values that the greater part of the relation is due to that of gram weight and pod weight, and to a less extent to gram weight and shoot weight. In order to understand more fully the significance of these relationships it will be necessary to know in what manner they are expressible.

The regression of the other characters on the gram weight:— If the characters, shoot weight and pod weight are sufficiently indicative of the gram weight, two conditions must be fulfilled. The first is that the relationship should be simple and definite; secondly a large proportion of the variation in gram weight should be expressible by them. In order to determine these two points the variance in gram weight due to the other two characters was analysed into the several components. (Fisher R. A. Statistical methods 1932 P. 231). The results are given in table II.

Table II.

Relation of Gram Weight to other characters.

ANALYSIS OF VARIANCE.

Relative	Control Bulks						Selections.					
	Shoot Weight			Pod Weight			Shoot Weight			Pod Weight		
	Freedom	Sum of Squares	%	Freedom	Sum of Squares	%	Freedom	Sum of Squares	%	Freedom	Sum of Squares	%
Variance in gram weight due to:-												
Linear regression.	1	1587·1	88·5	1	1715 1	95·7	1	5065·7	85·9	1	5666·5	96·1
Diviation from linear regression.	28	98·1	5·5	19	9·1	0·5	42	96·9	1·6	27	137·7	2·3
Within arrays.	171	107·5	6·0	180	68·5	3·8	355	735 6	12·5	370	93 0	1·6
Total.	200	1792·7	100	200	1792·7	100	398	5897·2	100	398	5897·2	100
Significance of departure from straight line.	Significant $P < \cdot 01$			Not significant.			Not significant.			Significant $P < \cdot 01$		

It is seen that from 86 to 96% of the variation in gram weight is accounted for by the simple relation of a straight line with the other characters. Even though the departure from linear regression is significant in two cases, the percentage attributable to this cause is low, (less than 5·5%). It can therefore be concluded that the gram weight of any selection or plant is expressible to a very large extent directly from the shoot weight or pod weight. The equations giving the relations of the characters are given below all weights being in ounces:—

	In Bulks.	*In Selections.*
Gram weight	= 0·4760 shoot weight plus 0·060.	0.4594 shoot weight plus 0·264.
,,	= 0·7329 pod weight plus 0·015.	0·7215 pod weight ,, 0·145.
Gram weight	= 0·139 shoot weight plus 0·540 pod weight—0·070.	0·091 shoot weight plus 0·601. pod weight ,, 0·060.
	(R = 0·9777).	(R = 9·0845).

The very high values of the multiple correlation coefficient 'R' indicate that a remarkable accuracy (about 95%) in gram weight is got by the combined characters.

The real advantage of the relations however lies in their applicability. From practical consideration even the determination of pod weight appears unnecessary. The labour of stripping the pods can be avoided and the preliminary selection made on the basis of shoot weight only with a fair degree of accuracy (nearly 90 %). If, for example, we require to choose plants or selections with 20 % increase over control in gram weight, the error involved by choosing those with 20 % and over increase in shoot weight will be negligible, the only condition necessary being that the harvest of the plants should be done when they are in a thoroughly and uniformly dry condition as in plants of the present study.

Summary. The pod weight, shoot weight and gram weight form a very closely related group of characters the coefficient of correlation exceeding 0·9 in all cases. When the effects of the different characters are independently evaluated the relation of gram weight and pod weight is most pronounced ($r_{pg.s.} = 0{\cdot}8$), while that of gram weight and shoot weight is next in importance ($r_{gs.p.} = 0{\cdot}4$).

The gram weight can be expressed directly as a simple function of either pod weight or shoot weight. The equations expressing these relationships are similar in bulks as well as selections and give an accuracy ranging from 86 to 95 %.

For purposes of preliminary yield trials it is not even necessary to determine pod weight. Selections made on the basis of shoot weight will hold good for gram weight without any appreciable loss of accuracy.

STUDIES IN POULTRY-KEEPING

Part III. NATURAL INCUBATION OF POULTRY

By R. W. LITTLEWOOD, *Deputy Director of Agriculture, Live Stock.*
and H. NARAHARI RAO, *Poultry Manager, Hosur.*

(Continued from the July 1933 issue of the M. A. J.)

Natural Incubation. The natural method of hatching i.e. by the employment of broody hens is right and proper for those who intend keeping fowls in a small way, say up to 100 chicks

Signs of Broodyness. Broodyness is a maternal instinct in all female species of birds. It is an irresistable tendency to sit on the eggs until the chicks hatch out, which nature has provided for reproducing the species. A country hen ordinarily lays 10 to 15 eggs in three or four batches and after each such lot, she goes broody. Broody hens can be recognised by:

(1) Ceasing to lay eggs,
(2) A partiality towards a dark corner where she would like to make a nest and sit undisturbed
(3) The feathers stand out when a person approaches it and the hen clucks.
(4) A general lack of appetite.
(5) A reduction in the size of the comb, wattles and the reproductive organs.
(6) A rise of temperature.
(7) A general lack of lustre throughout the face.

The average time for a hen to incubate her eggs is 21 days although this period may either be lengthened or shortened by the influence of the temperature to which the eggs are subjected. She can also be employed to incubate the eggs of other species of domestic fowls.

The following are the approximate periods of incubation of eggs for the different species of fowls.

Hen	21 days.
Duck and Turkey ...	28 days.
Goose	30 days.

Sitting hen. Care should be exercised to see that the hen is properly broody before setting. Very often it so happens that, when a hen shows the signs of broodyness, the eggs are set and the hen after a few days of sitting deserts the nest, which is a source of great disappointment, and loss.

To test that a hen is properly broody, one or two eggs or an artificial egg can be placed under her and tried for 2 or 3 days. If the hen settles to sit on the eggs properly, it can be taken for granted that the hen is properly broody.

Selection of a hen. A medium sized hen which is docile and in sound health should be selected; she must be perfectly clean with no lice or mites on her body; those with scaly legs should strictly be avoided for the reason that unless the hen is perfectly clean, she will pass on all the complaints to the chicks that she hatches. Some hens are clumsy, awkward and excitable and are apt to break the eggs every time they are let out and resettle. It is therefore necessary to watch the sitters carefully and if a hen proves unreliable, it will be a good thing not to use her for the purpose. Long-legged hens are generally clumsy and the breakages of eggs are more, although some of them happen to be good mothers. Short-legged variety of hens is more reliable and as such preference should be given to it.

Number of eggs to a hen. A good average size hen of imported strain can take from 10 to 12 eggs and a country hen 8 to 10 according to the size of eggs. Care should be taken to see that the hen is able to cover all the eggs properly. When the hen shuffles her eggs it is quite possible that one or two eggs might be left outside and consequently chilled. So it is always safe just to give her the number of eggs which she can conveniently cover and have the others removed.

The number of eggs that a hen can sit on depends on the breed and size of the bird as follows :—

	Hen of imported breeds.	*Country hens.*
Hens' eggs.	10 to 12 eggs.	8 to 10 eggs.
Ducks' eggs.	7 to 8 ,,	6 ,,
Geese's eggs.	5 to 6 ,,	4 to 5 ,,
Turkeys' eggs.	5 to 7 ,,	4 to 5 ,,

The Nest. It is a simple matter to make the nest, but special attention is required. A dealwood case about 18″ square with a trapdoor in front can be taken and the nest made out of hay or straw, over a layer of moist sand. On top of the hay or straw place some wood ashes; this helps to prevent lice etc.

It is necessary to put some ventilation holes in the sides of the box to enable free circulation of air. During the process of incubation if dry weather is experienced a little water should be sprinkled all round the nest to increase the humidity and also on the sand at the bottom of the nest. The nest proper should be made circular with a slight hollow in the centre covered with a layer of wood ashes as mentioned before. It should not be too deep as there is the possibility of the eggs rolling to the centre and consequently some breakages occurring amongst the eggs.

The box and the nest should be dusted with some disinfectant powder to keep off vermin. Powdered sulphur mixed with wood ashes, Sodium fluoride and tobacco dust, answer the purpose very well. A good powder can be made from a cigarette tin full of equal quantities of petrol and carbolic acids poured over one lb. of plaster of Paris and allowed to dry.

The nest must be examined for vermin carefully once a week and action taken; if it is not attended to the hen becomes restless and does not sit properly and when the chicks are hatched out, they will be found to be covered with lice or fleas and so their growth suffers. The nest should be scrupulously clean and should never be fouled. Any broken egg or droppings should be removed and any source of contamination should strictly be avoided. If however, the nest is fouled either by a broken egg or the hen's droppings, another clean nest can be made and the remaining eggs so contaminated should be washed in warm water about 100° F. and the hen immediately returned, to the nest.

Setting eggs. Fresh eggs of uniform good oval shape and size should be selected. Too small or abnormally big sized ones should be rejected. The shell of the egg must be of sound texture, free from ridges and encrustations. While selecting eggs preference should be given to those laid by vigorous and well matured hens.

Storing and holding eggs. When collecting eggs for setting, they should be kept in a dry, cool, airy place. In plains they should not be kept too long Under the best conditions, to get the best results, eggs should not be older than 4 to 6 days. In hill stations there is no harm in using eggs 10 days old. As the eggs absorb odour very easily it is not good to store them near smelly substances like onions, kerosine oil etc.

The hen and its treatment. After having arranged the nest as described above, the nest box should be placed in a partially dark, quiet place, where there is no disturbance.

The hen should be set preferably in the evening and should not be disturbed until the following evening. She must get plenty of grain food and drink before setting. From that day onwards she must be let out once a day at a stated regular time for feeding, exercise etc. This guarantees the cooling and turning of eggs at regular intervals.

Dust-bath. The fowls' natural method of cleansing themselves so as to be free from vermin and parasites is to take dust bath. So, the hen should be provided with a place for this which should contain sand mixed with wood ashes.

Feeding. Sitting hens should be given hard grain like maize, wheat, cholam, cumbu, paddy etc. The whole grains take a longer time for digestion and so the hen can sit comfortably on the eggs. Soft food like cooked rice and wet mash made of bran is not good for sitting hens. It is a bad practice to place either mash, grain or water in the nest itself for the hen to eat whilst sitting.

Good sitters generally do not come off the nest when required and so it will necessitate the removal of the hen by hand. While so doing it is quite possible that some eggs are concealed in her wings and dropped and consequently broken. This fact should be borne in mind while handling the bird. Usually good sitters go back to their nests after 15 to 20 minutes when they have finished their feed, drink, dust-bath etc.

This daily routine should continue with occasional dressing of disinfectant powder on the bird and the nest.

Testing of eggs. The eggs are tested on the tenth day of incubation. The simple method of doing is by means of a tube made out of a stiff paper, and holding each egg between the thumb and forefinger and middle finger exposed to the sun light and examining it through the tube. All eggs that appear clear can be taken as infertile and those that have spider-like structure inside with radiating lines which are the blood vessels, can be taken as " fertile " ones.

End of incubation. The 19th. day evening will be the final day for the hen to be allowed out of her nest. On the 20th. day the hen sits tight and the chicks start their active life. They pip on one side of the shell with their beak-horn and break open the shell and struggle. The whole hatch finishes on the 21st. day. It is not good to help the chicks to come out as such chicks will invariably be weaklings and hand assistance will cause injuries and damage.

Conclusion. Another clean hen coup should be kept ready for transferring the newly hatched chicks with the mother-hen. The hen can be given her food but the chicks should not be fed for at least 48 hours. The chick just before hatching takes in all the yolk material in the system and this serves as reserve food for a number of days. Such being the case, they should not be over-fed, as it is likely that they may get indigestion, diarrhoea, and in fact all sorts of complications. The first food for the chicks may be some finely broken grain eg. Wheat, maize, cholam and broken rice. Oat meal is the best food for young chicks. The mother hen will teach them to pick up grain and drink water and all we have to do is to house them properly and keep them free from lice, mites etc.

The essential factors for a successful hatching are moisture, heat and air. When a hen goes broody, the normal temperature of her body increases due to the accelerated flow of the blood in the system. This heat aids towards the maintenance of the eggs at a temperature of about 103° to 104° F.

An egg when placed in its normal position, the impregnated or the fertilized germ comes topmost. The yolk which contains the germ is of less specific gravity than the albumen and so it floats on it. It is the object in nature's purpose to bring the fertilized germ topmost, as near to the source of heat as possible. When a hen is let out for daily exercise (generally this occupies 10 to 15 minutes per day) she returns to her nest afterwards. Before she settles down on the eggs she shuffles the egg by which the object of turning is accomplished. If the eggs remain in the same position, there is the possibility of the developing germ sticking to one side of the egg and consequent death of the embryonic chick.

It may be mentioned here that the incubators are made so as to subject the eggs almost to the same conditions as they would be under a hen during the process of incubation.

MAIN POINTS OF SOME OF THE IMPROVED SUGARCANE VARIETIES FROM THE CULTIVATORS' VIEW POINT

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The sugarcane station at Coimbatore has evolved a number of new cane varieties which are rapidly ousting the indigenous ones in all the provinces. The thin and the medium thick canes are specially evolved to suit the demands of the North Indian cane cultivators who supply their canes to the mills. With a severe summer, when the temperature goes up to 110-112°F. for several days, and with an indifferent system of cultivation as is practised by most of the ryots in North Bihar under non-irrigated conditions, the only possibility of improving the cane supply for a successful cane industry is to evolve drought resistant varieties which give a fairly high tonnage and sucrose content.

The Agricultural Section at Pusa which has been the central agency for the distribution and spread of improved canes in the sugarcane tract, chiefly parts of the United Provinces, has been testing all canes sent out by the Imperial Sugarcane Station as to the suitability of growing them under the North Indian cultivators' conditions. The canes distributed by this section are spreading rapidly and all over the tract the improved varieties have come to stay. For instance, the 1931-32 estimates of the area under improved canes for the United Provinces and Bihar and Orissa (1930-31) would reveal the popularity of these canes.

	1931-32 Total Estimates	1930-31 Area under improved canes
United Provinces	1,554,000	over 70% of total area
Bihar and Orissa	279,000	70,484

For these two provinces especially, sugarcane cultivation has been the sheet anchor for the agriculturists and the indigenous varieties are being displaced rapidly. This will again be evident from the fact that in 1930-31 season, 66,748 lbs. of sugarcane setts were distributed by the Imperial Department of Agriculture (1930-31). It will not be too much to say that today, the sugarcane industry in this tract is entirely dependent on the improved canes and in no respect has the readiness of the cultivator to accept an improvement been clearer, than in his adoption of the improved canes distributed by the Agricultural Section, Pusa.

In view of the added impetus to the sugarcane industry by way of sugar tariff of Rs. 7—4—0 per cwt. on foreign sugar, and the consequent increase of the area under sugarcane, it is but fitting that an attempt should be made to make a comparative study of the improved canes which are now, or shortly will be, available to the cultivator.

The more important canes which have so far been distributed by the agricultural section, or are being tried on an extensive scale under normal conditions, are the following :—

Co. 210, Co. 213, Co. 214, Co. 281, Co. 285, Co. 299, Co. 312, Co. 316, Co. 331 and Co. 205.

Co. 210 is of comparatively shorter growth than Co. 331. Canes are zig-zag, joints purple, internodes of medium length (four to five inches); canes are round, purple, with abundant foliage of light green colour, leaves long, of medium width, and of spreading curvature. Tillers good and five to six ; the variety is a drought-resistant. It is now the standard cane and grown all over North Bihar. Yield six to seven hundred maunds per acre on good land ; Sucrose 16 per cent. This is suitable to lighter lands, but grows on any type of soil.

Co. 213 has an erect habit, with canes usually straight, joints purple. Foliage is dark green and abundant ; long, wide lamina. Canes straight, medium thick (thin upward) round, internodes of medium length (three to four inches), pink : buds prominent and round. Tillers 5—6. Length of cane is four to five feet. It has aerial roots. It is less drought resistant than Co. 210. This is fairly resistant to water logging. Yield is 650 maunds per acre on good land. Sucrose 16 per cent. It needs better land. and optimum conditions as regards manuring and cultivation. It withstands lodging.

Co. 214 :— This shows a lodging habit especially in rich land. It is very much like Co. 299 with sub-erect habits ; crooked cane. leaf-sheath not easily separated, abundant but dark green foliage, long narrow lamina ; nodes even with joints, fair tillering ; internodes of medium length : prominent round bud. Length of nodes three to five inches, height four to five feet. Yield about 400 maunds per acre. It is fairly resistant to water logging. The earliest cane not a heavy yielder (400 mds. per acre) but contains high percentage of sucrose. A premium is paid for these canes. It has more than 18 per cent. sucrose. Though this lodges, there is less deterioration in the juice than in other varieties. Its germination is good and uniform. During monsoons its growth is slow.

Co. 281 is an optimum cane. It yields about 600 maunds per acre and has a high sucrose content which goes up to 18 per cent. It is an early cane, ripening in November ; does not lodge ; but, under ordinary cultivation the variety does not come up well. Its foliage also dies up early and besides is susceptible to the attack of white ant at all stages and of jackals if allowed to remain after December.

Co. 285 has an erect habit, with erect canes, greyish white joints ; with leaf-sheaths not easily separated. It has dark green abundant foliage ; leaves with long narrow lamina ; thin hard canes with nodes a bit thicker than joints, round, and internodes of medium length.

Buds are not so prominent. Tillers well (eight), rich in sugar content. It lodges to a slight extent. If allowed to stand the buds begin to sprout. It is attacked by jackals.

It grows on any land but better on low land which is particularly suitable to it and grows on conditions similar to Co. 205, to which it is preferred, being less fibrous. It yields about 700 to 800 maunds per acre and the sucrose content is 15 per cent. This germinates quicker than most other varieties and grows very quickly in hot weather. The cane formation is quite early. It stands water logging.

Co. 299 seems to do better than Co. 214 and has no tendency to lodge; the canes are zig-zag, yellow jointed, with leaf-sheaths not easily separated. It has a light green abundant foliage. Leaves have long narrow lamina, with erect curvature. Canes are medium thick, the base being thicker; nodes are even with joints; tillering is rather poor. Buds are not prominent. After passing through a rather severe summer with temperature going up to 110 to 112° for over a week, this cane has done better than Co. 214 in tonnage. It promises to be an early cane and may replace Co. 214. In comparison it is a heavy yielder and possesses good agricultural habits. The sucrose content is 17 per cent. The yield is 600 maunds, although it is a little lower on poor lands. It is not a fast grower, but stands drought well. Germination is not uniform, and is slow and late.

Co. 312 is a fast growing variety with pale green leaves. Its germination is good and uniform; tillering good; stands bad weather better than other varieties. This is a soft medium cane and has many good agricultural points except for its tendency to lodge in rich land. Canes are thin, internodes of medium (3—4″) length. Sucrose content varies from 13·26 to 16·59 per cent. The yield is 600 maunds.

Co. 316 canes are crooked and have a tendency to lodge; Joints are brown, leaf-sheaths are easily separated, leaves are long and broad, canes are medium thick, with internodes of medium length, 3-4 inches. Tillers fairly well on good land. Its yield is about 350 maunds per acre. It is being tried on light soils. It stands water logging. Sucrose content varies from 14·65 per cent on low land to 18·81 per cent on high land. This is not good as a drought-resister and cracks badly. It is a juicy medium-thick cane.

Co. 331 is a promising variety and has excellent agricultural habits. It is a tall strong erect growing variety, with medium thick purple canes, with fairly long nodes (6—8″). Leaves are long, erect and tough. It tillers fairly well (eight). It resists droughts well and gives a good tonnage but matures late; sucrose content is 15 per cent. Yield is 720 maunds as calculated from a small area.

Co. 205 is, from the point of the mill not a desirable variety as it contains over 20 per cent. of fibre. But it is specially suited to water logged situation, where it grows vigourously with bushy growth. It tillers fairly well. People in the Punjab prefer this because the *gur* (jaggery) made from this is of superior quality and the variety is less liable to damage by men and animals than other varieties it. Further it grows on poor land with less manuring. These and a few more are still under experiment. The sucrose content is 14 per cent. and the yield 400 maunds

Yield, sucrose percentage and main points at a glance.

Variety	Average yield.	Sucrose %	Remarks.
205	400	14	Late cane. Fibre over 15 per cent
210	600-700	16	Standard cane Drought resistant. Grown on light lands.
213	650 on good land	16	Needs better land. Stands water logging to a certain extent.
214	400	18	Earliest cane. Premium offered by mills. Fairly resistant to water logging.
285	700	15	Suitable for low lands. Less fibrous than Co. 205. Grows on similar conditions. To be preferred to Co. 205.
331	720 1931 trial	15 (1931 analysis)	Excellent agricultural habits but late variety. Resists drought well.
312	600	15·5 (1931 analysis)	......
316	400	16 (1931 analysis)	Being grown on light lands.
281	600	18	Optimum cane. An early cane ripening in November.
299	600	17	Seems to be better than Co. 214 in tonnage Has good agricultural habits. Promises to be an early cane and may replace Co. 214.

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"CHROMOSOMES AND PLANT BREEDING"*

The lecture dealt with the study of chromosomes in relation to sterility. Sterility could be classified under three heads. (1) Relational sterility, where the pollen grains of one plant are not able to grow on the styles of the same plant. This is due to self incompatibility which is governed by the interaction of certain genes; (2) Morphological sterility where malformation of sexual organs enters into the causation of sterility and this is also genetically determined and is governed by a single gene; and (3) Generational sterility, which is, by far the most important, is due to the segregation of chromosomes at meiosis.

*** Abstract of a lecture delivered by** Dr. C. D. Darlington Ph. D., D.Sc. Cytologist, John Innes Horticultural Institution, London, under the auspices of the Association of Economic Biologists, Coimbatore on 13th August 1933.

This kind of sterility is most often met with in interspecific or intergeneric hybrids and are due to particular behaviour of chromosomes at meiosis. The different types of chromosome behaviour contributing to the causation of sterility may be classified as under:—(a) *Raphanus* × *Brassica* hybrids. These are completely sterile. Cytological examination of the meiosis of these plants reveal non-pairing of the two haploid parental chromosome sets with the result, that the univalents are assorted at random to the poles as in the case of haploids. By this chance and irregular distribution of chromosomes it is hardly possible to get gametes with viable sets of chromosomes and the result is almost complete sterility. (b) *Primula kewensis*. In this type, the haploid chromosomes of *Primula sinensis* and *Primula floribunda* pair together and simulate normal meiosis but still we meet with complete sterility. This could be explained by the segmental interchange of chromosomes taking place at meiosis, being brought about by the crossing over and chiasma formation in them. This segmental interchange brings on unbalance of chromosomes in the gametes and the result is the occurrence of sterility. (c) Triploidy as a cause of sterility is known in many plants. In triploids, instead of the two normal sets of chromosomes present in diploids, there are three homologous sets and at meiosis the extra odd se[illegible]ering without its partners and the result is irregular distribution of chromoso[illegible]ough a poles and consequent formation of a large percentage of non-viable gametes. While triploidy among cereals, where seed production is all important, is of no advantage, among horticultural varieties, triploids have been found to be of great use. Many of the ornamental plants of Japan like the hyacinths and tulips are triploids. (d) Tetraploidy has also been a source of generational sterility. While tetraploids derived from diploid hybrids by duplication of the chromosomes, have been found to be mostly fertile, those arising in homozygous diploids by duplication of chromosomes are found to exhibit marked sterility. The reason is that in such tetraploids, there are four homologous sets of chromosomes and these by interchange of segments owing to crossing over and chiasma formation at meiosis, bring about unbalance in the gametes with the result that only a small percentage of the gametes are viable and hence there is reduced fertility.

The lecture at the end touched upon the definition of hybrids, which differs from the points of view of the taxonomist and the cytologist, as instanced in the case of *Oenothera*.

ABSTRACTS

Disintegration of Bones. D. L. Sahasrabudhe (*Agri. and Live-stock in India, 1933, vol. 3, pp. 264—271*). The present paper reports a comparison of some simple methods which can be adopted by the farmer to render bones friable and easily powdered. Bones cost about Rs. 7 to 8 per ton in the village, but the factories sell bone-meal at Rs. 70 to 90 per ton or even more, a major part of the difference being due to high transport charges, and the price could be easily brought down to about Rs. 30/- to Rs. 35/- per ton, if small scale plants be started in village centers, adopting simple methods for the preparation of bone-meal. Experiments carried out with a Simplex Crusher, worked by hand, showed that a preliminary treatment of bones with water for 2 months reduced the time required for crushing from 95 minutes to 45 minutes; bones treated with 2 per cent hydrochloric acid for one month required 45 minutes; those treated with 2 per cent sulphuric acid required 60 minutes. Treatment with alkalies was better; soaking in 5 per cent caustic soda for 8 days reducing the time of crushing from 95 minutes to 10·5 minutes. 5 per cent washing soda (8 days soaking) reduced the time required to 32 minutes only and was not so effective. Treatment with bulky materials by storing the bones mixed with soil, farmyard manure, cattle-dung or urine-required a long period (4 months) for the time of crushing to be brought down to 25 minutes and is not considered useful for the purpose in view. Heating the bones in an autoclave, under steam pressure at 140°C for two hours rendered the bones easily crushable by hand, but dry heating between iron plates was not so effective, 5 hours heating at 150°C reducing the period of crushing to 13 minutes. Charring and half charring the bones using dry leaves and farm refuse as fuel. at the rate of 16 lbs. fuel per 100 lbs. bones for full charring and 10—12 lbs. fuel for half-charring, was found to be very effective. The fully charred bones could easily be crushed by the fingers, while the half-charred bones were easily crushed in the mill (10 minutes). A comparison of the economics of the different methods showed that the cost of a ton of the bone-meal prepared was as follows:—(a) by 5 per cent caustic soda Rs. 57/-, (b) by 5 per cent washing soda Rs. 35·7; (c) by half charring Rs. 16·5; (d) roasting Rs. 13·5. The last two methods are recommended for adoption at village centres. (C. N.)

The effect of the contact of Chemical fertilisers with seeds on their germination. V. G Gokhale and P. M. Gaywala (*Agri. and Live-stock in India, 1933, vol. 3, pp. 256—263*). Sometimes the practice has been recommended of sowing the fertilisers along with the seed, as one securing economy in cost of application besides giving greater yields than later applications of fertilisers; but the practice has one draw back, namely, the harmful effect on germination exerted by the concentrated fertilisers coming into contact with the seed sown The authors have examined the conditions under which such a harmful effect is observed and arrive at the following conclusions:—(1) The effect on germination is most injurious when the mixture of cotton, *jowar* (*Sorghum vulgare*) or *bajri* (*Pennisetum typhoideum*) and sulphate of ammonia at the rate of 100 lbs. per acre is dibbled in pinches, thus bringing about direct and concentrated effect. Cotton seeds were found to suffer comparatively more than *bajri* or *jowar*. (2) Drilling of the above mixture seems to lessen this contact and concentration and thus to effect a marked improvement in germination over (1), due to intervention of soil between the seed and the fertiliser. (3) The injury to germination is practically nil when the contact and the concentration of the fertiliser with the seed are still further lessened as by drilling the fertiliser 3 to 4 feet behind the dropping of the seed in the same furrow, or by applying the fertiliser separately either before or after sowing. (4) The contact of the fertiliser (sulphate of ammonia at the rate of 6 oz per two tolas of *bajri* and cotton seed or eight tolas of *jowar* per plot of 4 ft × 40 ft.), with the seed up to 2 days in the dry condition of both did not effect any appreciable difference in germination. (5) The failure of germination occurred only when the fertiliser comes in concentrated and direct contact with the seed under the soil conditions favourable for germination, i. e. moist soil etc. (C. N.)

Live Weight of cattle by measurement. S G Singh (*Agri and Live Stock in India, 1933, vol. 3, part 2, pp. 141—151.*) Several formulae have been used in Western countries to estimate the weight of animals from certain body measurements, but the author found that these were not applicable to cattle in India. He finds a formula recently devised by Capt. C. E. Macguckin (*Ind Jour. Vet. Sci. and Animal Husbandry 1931. vol. 1, part 3*) to be better than others, viz:—

$(\text{Girth})^2 \times \text{length} \times 5{\cdot}5 =$ Live weight of the animal in pounds. The girth is measured just behind the shoulders to represent the circumference of the body, and the length as the distance between the square of the buttock and the square of the shoulder. The readings for length were taken from both sides and averaged to eliminate the effect of different postures assumed by the animals at the time of measuring. Girth and lengths are expressed in feet. In actual practice this formula was found to work fairly well in the case of large animals, but it did not give satisfactory results for small cows of the Montgomery breed, for which the author devised the following modified formula :—

$G \times L/X$ = Live weight of the animal in seers, where G is the girth of the animal in seers, L the length of the animal in inches and X was a variable factor whose value was found by experiment to vary with the size of the animal as follows :— X equals 9 or 8·5 or 8 according as the girth of the animal is below 65 inches, between 65 and 80 inches and above 80 inches respectively. The new formula was found to give better results than that of Capt. Macguckin for all cows, including the small ones of the Montgomery breed. (C. N.)

Studies on germination and growth in groundnut (*Arachis Hypogaea, Linn*)— Ali Mohammad, Zafar Alam, and K. L. Khanna. (*Agriculture and Live Stock in India, 1933, vol. 3, part 2, pp. 91—115*). (1) In groundnut, earliness in maturity appears to be associated with the erect habit, and lateness with the spreading habit of growth. The spreading varieties show a greater power of disease resistance than the erect growing varieties. (2) Germination tests carried out in the field showed that :— (a) Best germination is obtained by sowing seeds instead of pods. (b) Pods soaked in water for 24 hours before sowing give 16 to 20 per cent. more germination than unsoaked pods. (c) Seeds soaked in water for 12 hours before sowing give quicker and more uniform germination than unsoaked seeds. (d) Seeds with their testas partly or wholly removed fail to send up their seedlings above ground ; this inability is traced to fungus attack on the seeds after sowing. (e) Seeds with portions of cotyledons removed gave less germination than entire seeds, and the root and shoot development of their progeny was also very poor. (3) A comparison of three varieties at different stages of growth showed that the "Burmese" exhibited a much more vigorous root and shoot growth than the other two varieties viz., "Small Japan" and "Small Spanish", of which the latter appeared to be better suited to withstand drought. (4) The formation of leaves and flowers in groundnut has been shown to proceed simultaneously. The period of maximum vegetative growth and flower production lasts from 56 to 97 days and from 70 to 125 days after sowing, respectively in the case of erect and spreading varieties. This is a critical period of growth and importance of a plentiful water supply during this period has been pointed out. (5) A close correspondence has been found to exist between the root and shoot development in the different varieties studied. (6) The groundnut plants grown in sand or clay showed a very poor development The addition of *Kankar* to clay proved beneficial. The application of lime to soil encouraged both root and shoot development in the early stages of plant growth atleast and induced early flowering. The application of ammonium sulphate retarded the growth of plants and delayed flowering. Lime promoted the formation and development of nodules on roots to a great extent and ammonium sulphate inhibited their formation. (Author's summary)

Relative merits of High and Low Silage Feeding to Cows in Milk. K Gupta and R. S. Gupta. (*Agri. and Live Stock in India, 1933 vol. 3 part, 2 pp. 116—124*). Two groups A and B, each consisting of 20 freshly calved cows (Sindhi and cross bred) were fed, A with 41·25 lbs. of silage and B with 24·75 lbs. of silage per 1000 lb. body weight (average live weight 600 to 700 lbs). Ragi straw was given *ad lib* to both the groups as the supplementary roughage, and in addition, a concentrate mixture of wheat bran, brewery grain and groundnut cake at the rate half a pound of the mixture per pound of milk produced; also 1·426 lb. of groundnut cake per 1000 lb. live-weight to ensure an ample supply of protein for maintenance. The experiment which ran over four weeks, showed that: (1) the cows getting less silage consumed more *ragi* straw, and thus the total food consumed by the two groups A and B were almost equal (about 32—33 lbs. dry matter per day for 1000 lb. body weight) (2) There was a greater increase in live weight in group A which was getting more silage, but the quantity and quality of the milk obtained from the two groups was almost identical. (3) Since silage is costlier than *ragi* straw, the authors conclude that feeding of lower silage as in group B, (24 lb. per 1000 lb. live weight) is economical, especially as it does not decrease either the quantity or quality of milk. (C. N.)

The composition and Fertilising value of Sewage Sludge. G S. Fraps. (*Bulletin No. 445 of the Texas Agri. Expt. Station, U. S. A., 1932*). Sewage sludge obtained as a by-product from the purification of sewage, is of two varieties, viz. the *Digested Sludge*, produced in the Imhoff process where the raw sludge is kept in closed tanks and undergoes an extensive decomposition by the action of Bacteria and other organisms whereby the less resistant portions of the organic matter is destroyed and the more resistant portions settle down, and secondly, the *Activated Sludge*, obtained by seeding the sewage with activated sludge and pumping air through the mixture, whereby an extensive growth of protozea and other organisms is produced which adhere to the suspended solids and cause them to settle. While the digested sludge consists of the resistant parts of sewage organic matter, the activated sludge contains, besides the organic material of the sewage, bodies of the organisms which produce clarification, and hence contains more nitrogen than digested sludge and is more easily nitrified in the soil. Analyses of dried *digested sludge* showed that it contained on an average about 1·9 per cent nitrogen, 1·6 per cent total phosphoric acid, of which about 1·1 per cent is available, and 0·2 per cent potash. *Activated sludge* when dried usually contains over 5 per cent of nitrogen and 2 per cent of available phosphoric acid, and about 0·2 per cent of potash. It has about 70 per cent of the fertilising constituents of cotton-seed meal. Both the dried sludges contain 33 to 76 per cent of ash chiefly insoluble in acid; grease, pentosans and crude fibre are also present. Pot experiments to determine the availability of nitrogen and the rate of nitrification showed that the availability of the nitrogen of digested sludge was variable and averaged about one half of that of cotton seed meal. The availability of the nitrogen of activated sludge was about equal to that of cotton seed meal, and it nitrified more easily Dried *digested sludge* contains somewhat more plant food than farmyard manure, but is a poorer source of humus. Dried *activated sludge* is a nitrogenous fertiliser similar to cotton-seed meal and has about seven-tenths its value. It can be used alone or in the preparation of mixed fertilisers. (C. N.)

Studies in South Indian Pastures I Seasonal, variation in the mineral and nitrogen content of spear Grass (Andropogen contortus)—P. V. Ramiah (*Indian Jour. Vet. Sci. and Animal Husbandry, 1933, vol. 3, part 1, pp. 65—84*). The investigation reported here consisted of a study of the mineral matter and protein of the herbage (the main flora being *spear grass*) of four paddocks at Hosur during two seasons in 1929 and 1930 The results obtained which are similar to those reported from England and other countries, show that the main factor determining composition of herbage is the stage of growth, though seasonal conditions and incidence of rainfall exert a subsidiary influence. Nitrogen and phosphoric acid curves followed a parallel course, while the calcium curve varied inversely as the other two. The deficiency of the soil in calcium and phosphoric acid was reflected in a deficiency of these too essential constituents in the herbage. The author opines that the pasture would just meet the maintenance requirements of an adult working animal, while growing animals and milch cows are both in danger of a deficiency if grazing on the herbage alone without the supply of a concentrate. A mineral supplement is recommended for use as a prophylactic in such cases The best period for mowing for silage or hay making was found to be that when the grass had flowered and before the seeds had set. (C. N.)

Disintegration of bones by Alkali method and their use as fertilizers. M. A. Hossain (*Agri. and Live-stock in India, 1933. vol. 3, part 2, pp. 152—165*). This is a continuation of previous work by Sen and Hossain (Agri. and Live-stock in India, 1931, vol. 1, p. 151) wherein it was found that caustic alkali plus common-salt gave good disintegration of bones. The present paper gives details of the optimum conditions under which the disintegration could be brought about. The raw bones are kept dipped in a solution containing 1·5 per cent caustic soda and 1·0 per cent common-salt for about 2 months in air tight vessels. The ratio of bones to solution recommended is 1:4. The used up liquid can be re-used for two more subsequent treatments, renewing the alkali only. Details of a simple and convenient process are given which can be adopted by the cultivator himself, using kerosine tins, commercial caustic soda and common salt. The cost of preparation of the alkali treated bones is very low; it is about Rs. 1—14—0 per maund, excluding labour charges, as compared with about Rs. 5—8—0 per maund which is the price of bone-meal and bone super-phosphate The alkali treated bones were found to be superior to bone-meal or bone-super in respect of phosphoric acid content. Pot culture experiments with Dacca soil which was extremely poor in total and available phosphoric acid, showed that the bone fertilisers prepared by the alkali process gave as good yields as superphosphate (C. N.)

Russian methods of artificial insemination Water Landauer. (*Journal of Heredity, vol. 24, No. 3*). The article describes the methods adopted in Russia for artificial insemination of sheep. In Russia, a country of great distances, the economic programme calling for rapid improvement of existing livestock made it imperative to use the expensive purebred sires which had been imported from foreign countries to the greatest possible extent in grading up local herds. This naturally gave new impetus to attempt at perfecting the methods of artificial insemination. It seems probable that artificial insemination will play an important role in the future of livestock breeding in general, since it will enable breeders to make much more rapid progress towards reaching the goal of their breeding programme. Although the methods described have been specially worked out for sheep, very similar ones are used in Russia for house cattle and pigs. During 1931 in Russia one of the methods was used for the insemination of several hundred thousand sheep and of about 187,000 cows; it has also been used for horses and donkeys. Essentially all the methods consist in collecting the sperm from the vagina of the animal after it had been served and injecting the same into the vaginas of other animals. During 1930, it was found that the sperm of a single can when fully utilised was sufficient to inseminate from 300 to 400 ewes during one season. One service of the ram on the average gave enough sperm to inseminate six ewes. About 90 per cent. of all ewes inseminated, became pregnant which is as high as can be expected under normal breeding conditions. As many as 400 cows can be inseminated from a single service of a bull, and as many as 1250 cows have been actually inseminated from one bull in the course of a year. Ordinarily, the possibilities of utilising the sperm will be limited by the available number of animals which are in heat. Experiments have been made, however, concerning the possibility of keeping the sperm. With a special glucose phosphate dilution fluid, and at a temperature of from 10 to 15°C it was found that raw sperm could be stored for 18 days and still be used for successful insemination. Studies are also being made in Russia concerning the possibility of inducing heat periods experimentally. (K. R.)

Gleanings

Jute cloth for road surfacing. An interesting experiment involving the use of jute cloth in road surfacing has recently been tried in Calcutta by the Indian Jute Mills Association. The work was carried out by Messrs. McLeod & Co., with the co-operation of the Public Works Department of the Government of Bengal, on a stretch of the Strand Road one of the most important thoroughfares in Calcutta After being scraped and cleaned, the road surface was coated with bitumen and then laid with Jute fabric. The fabric was then again coated with bitumen, covered with a layer of fine stone metal and rolled so that the upper coating of bitumen penetrated the cloth and formed a solid mass with the bitumen underneath; at the same time the stone chips adhered to the bitumen and fibre, producing the wearing surface. The stretch of road so treated is behaving exceptionally well and has retained a better appearance than another stretch of road which was built at the same time without the Jute cloth (*Chemistry and Industry, April, 28, 1933*).

Russian Research on Plants of Waste Land. The *March, 1933* number of *Revue de Botanique Appliquee d'Agriculture tropical* contains a summary of recent Russian work which might prove of considerable value under Indian conditions. Although the intensity of cultivation differs greatly between the thinly populated South Western Steppes and the typical village lands of India, there is much waste-land in both areas which is only occasionally cultivated and left to lie fallow for long intervals. It is in such places that this research work aims at finding more or less perennial crops which need little tending and which will not exhaust the soil, but which will yield some revenue. Those mentioned include several common Indian gemera or very similar plants, the chief classes of which are gutta-percha-yielding *compositae*, tawnin-yielding plants, grasses containing ethereal and scented oils, grasses for paper and pulp, and several common herbs, which yield a mucilage substituted for mineral paraffin oils as laxatives, eg., *Salvia aegyptica, Plantago, amplexicaulis* and *Lallamantra royleana. (Indian Forester, August 1933)*,

Notes & Comments.

Advisory Board Meeting of the Imperial Council of Agricultural Research. Several schemes have been discussed at the recent meeting of the advisory board, the most important of them being the question of the improvement of the standard of Veterinary education in India and the consideration of the draft curriculum framed by the Committee of experts appointed for the purpose. After considerable discussion it has been agreed that there should be a minimum course of three years which should be raised to four in each College as soon as local conditions permitted. During the discussion it appears to have been suggested that because there were many unemployed veterinarians, there was no necessity to train more young men as veterinarians. It cannot be said that the existing facilities for the ryots to protect their cattle againt diseases are yet adequate, and it will not be wise for Governments to cut down expenditure on veterinary education on the score that there are several unemployed qualified veterinarians. The suggestion, however, thrown in the discussion that a multiplicity of Colleges might be avoided, deserves attention. A few colleges with the standard of education as high as would be necessary would certainly be far better than a large number where the quality of training was indifferent, It has been rightly pointed out that the existing rate of pay for the veterinary surgeons was rather low considering the huge amount of disease prevailing in the country and the importance of the study of Animal Husbandry to India. We should suggest that the standard of training in the Veterinary Colleges must be improved and the pay and prospects of the qualified men brought on a par with those of the Agricultural graduates. We are glad to note in this connection that there is a proposal to affiliate the local Veterinary College to the Madras University and this when it meterialises should be a move in the right direction as it must indirectly improve the standard of education imparted there.

Among the other subjects that were discussed by the Council may be mentioned (1) The scheme for the investigation and cultivation of medicinal plants of the Punjab; (2) The scheme for combating the *Koleroga* disease of areca palm in Kanara. Bombay; (3) Grant for research into malting and brewing tests of improved barley; (4) Investigation into Johne's disease among animals in Mysore; (5) Scheme for the biological study of the alkali soils in the Punjab; (6) Continuation and extension of the grant for satistical studies relating to Agricultural work in India under the Professor of Physics, University of Calcutta; (7) Scheme of poultry breeding research in Western India and (8) Sugarcane Research in N. W. Frontier Provinces.

It is well that regarding item No 2 there has been differences of opinions expressed at the Council meeting. The question is whether the grant applied for by Bombay is for the purpose of conducting research or for applying the lessons of research. The Council, we believe, can entertain schemes only for conducting research while the practical application of results obtained from research must be the business of the provinces concerned. Provinces like Madras and Mysore have already extensively adopted the latter and successfully carried out practical demonstrations about combating the disease. We hope the application of Bombay for the grant was for the purpose of doing more intensive research on the disease itself.

Fruit Farming and Canning of Fruits. We understand that as a result of successful experiments in canning and colouring of certain classes of fruits conducted under Government auspices, the Ceylon Department of Agriculture is contemplating the formation of a separate branch of the Department which will be in charge of fruit culture in the island. Extensive experiments are being carried out in fruit farming. They are also intending to provide the Agricultural Chemist with a plant to enable him to continue his experiments in fruit colouring and fruit canning. Experiments on artificial colouring of locally grown oranges and mangoes are reported to have been successful with the result there are now produced in Ceylon oranges having the same colour as the Australian, Jaffa and Californian species. In the meantime the Ministry of Agriculture and Lands is engaged in studying the question of finding markets abroad and problems of shipping and cold storage. In this connection we are glad to note that the proposal to open a fruit farm in Madras with the funds provided by the Imperial Council of Agricultural Research is materialising. A suitable site for the station has been selected at Rajampet in the Cuddappah district and the acquisition proceedings are awaiting the acceptance by Government of the Director's proposals. That the production and consumption of more fruits in the country is necessary for the maintenance of good health is now being increasingly recognised. That the people in parts of Kistna and Guntur are devoting more and more of their dryland for planting oranges and limes is a hopeful sign. The opening of a fruit farm by the Department is expected to be of great help to the fruit growers in teaching them what fruits to grow and how to grow them. The question of canning fruits is not a problem to be worried about for the present in as much as we do not produce enough fruits even for local consumption. As a corrollary to the opening of the fruit farm we would urge the Government for their earnest consideration the necessity for making a comprehensive study of the existing markets and to evolve a scheme for regulating and organising them. The control of the fruit markets has already engaged the attention of Bombay and without similar impetus from the local Government, the scheme is not likely to result in the maximum benefit for the cultivators.

Rice Trade in Madras. We have reviewed elsewhere in this issue, the world rice situation for 1932-33. Burma as usual, practically monopolises the foreign export trade of India in rice. For 1931—32 Burma contributes 87·8% of the whole export, Bengal 5·4% Madras 2·7% and all the other provinces put together the balance. To check the existing adverse effects of a big import of cheap Burma rice into Madras it is necessary that Madras should at least maintain if not improve the small share of export which she is now having. The two chief obstacles standing against its maintaing this export trade are (1) the absence of organised marketing agencies and (2) the high freight charges. The agitation and representation of the rice growers in Tanjore district (which contributes mostly to this small export trade), to the Railway and getting them to reduce the freight charges have had a very desirable effect, in that exports of rices to Ceylon during the last two months have appreciably increased. We should like to point out that Madras contributes nothing to the export of rice, raw, par-boiled and broken to the United Kingdom, the monopoly almost exclusively resting with Burma. The London prices of the American and Spanish rices which are the ones chiefly consumed in the United Kingdom are found to be 2·3 and 1·4 times respectively that of the Burma rice. The samples of these three rices as sold in London have been obtained, and it is found that the quality of some of our rices, particularly the variety *Nellore Samba* grown on a commercial scale all over Madras is as good as the Spanish and distinctly better than the

Burma rice. Taking advantage of Ottawa pact, we understand, that even Australia is trying to find a market for her rice in Great Britain but it is believed she will never be able to compete with India because of her higher cost of production. It appears to be a feasible proposition for even Madras to send some of her rices to England. While the export of Burma rice is well organised and there are agencies in England to exhibit the products of that country there is no such agency for Madras. It is up to the Tanjore Rice Syndicate which is newly formed to try and explore the posibilities in this line. It must be remembered, however, that greater attention must be paid to the milling and cleaning processes in the country so that the finished product—cleaned rice—will have the same attractive appearance as the American and Spanish products and thus catch the attention of the consumers there.

A Lecture by Dr. C. D. Darlington. The usefulness of the existence of a scientific association like the Association of Economic Biologists, at the Research Institute was apparent in that it was able to get Dr. C. D. Darlington, Cytologist, John Innes Horticultural Institution, London, who had come on a casual visit to Coimbatore to see the famous sorghum—sugarcane hybrids, to address the association on "Chromosomes and Plant Breeding". He is one of the greatest cytologists of England at present and is the author of an important book "Recent Advances in Cytology" published recently. The importance of Cytology to Genetics and Plant Breeding is now well recognised and every plant breeder has to keep himself in touch with the latest developments in this branch ot science which is progressing by leaps and bounds in recent times. Dr. Darlington has in his book formulated his own hypothesis about nuclear structure and phenomenon of crossing over in chromosomes, and it is a matter we have to congratulate ourselves upon in that we were able to hear an exposition of this new hypothesis from the author himself. In spite of the fact that his stay in Coimbatore was so short, hardly 36 hours, he found time to visit the laboratories and stations of all the Plant Breed[illegible] Sections, and go through critically the cytological work that has [illegible] going on in each of these sections. The plant breeding sections mu[illegible] be deeply indebted to him for the many helpful and highly instructive suggestions he gave about further cytological work. The subject matter of his lecture is abstracted elsewhere in this issue.

Crop & Trade Reports.

Cotton Crop Report, Madras, 1933-34, First Report. The average of the areas under cotton in the Madras Presidency during the five years ending 1931—'32 has represented 9·0 per cent. of the total area under cotton in India. 2. The area under cotton up to the 25th July 1933 is estimated at 176,500 acres. As compared with the area of 210,000 acres estimated for the corresponding period of last year, there has been a decrease of 16 per cent. 3. *Central Districts and South—mainly*

Cambodia tract. The area in the Central districts and the South represents the last year's crop left on the ground for second-pickings before the plants are removed in September in compliance with the provisions of the Pest Act. The area in these districts fell from 137,100 acres to 115,500 acres *i. e.*, by about 16 per cent. The yield is expected to be below normal due to the want of sufficient showers in June. 4. *Deccan or Northerns and Westerns tract.* In Bellary, where the early crop is sown in June, the area rose from 22,500 to 28,000 acres owing to the good rains received in May. In the other districts the area has fallen owing to the inadequacy of timely rains. 5. *Cocanadas tract.* There has been a decrease in the area in Guntur and Nellore due to the insufficiency of timely rains. 6. The wholesale price of cotton lint per Imperial maund of 82—2/7 lb., as reported from important markets towards the close of July 1933, was about Rs. 18—10—0 for Cocanadas, Rs. 16—14—0 for red northerns, Rs. 18—2—0 for white northerns, Rs. 16—7—0 for (early crop) Westerns, Rs. 25—4—0 for Cambodia, Rs. 23—2—0 for Coimbatore karunganni, Rs. 24—11—C for Tinnevelly karunganni and Rs. 20—13—0 for Nadam. (*From the Board of Revenue, Madras.*)

All India Preliminary Forecast of the Jute Crop, 1933. The total area under Jute in Bengal, Bihar and Orissa and Assam, for 1932, has been revised to 2,143,000 acres and yield to 5,845,000 bales, as against 1,899,300 acres given in the final forecast in 1932. The estimated area of jute in the above three provinces for 1933, is 2,479,830 acres, an increase of 336,700 acres, or about 15·7 % as compared with the revised total for 1932. (*Indian Trade Journal, July 13, 1933.*)

The World Sugar Situation. Production. The estimated world production of cane and beet-sugar during the year 1932—33 sugar season is placed at 26,821,000 short tons, according to the latest estimates received from official sources, the International Institute of Agriculture and trade estimates. The current figure, 9 % below that of the preceding season, is the lowest world crop reported since 1926—27 when 26,624,000 short tons were produced. The world beet sugar crop, estimated at 8,670,000 short tons is 874,000 short tons less than last year, while the cane sugar production placed at 18,151,000 short tons, shows a reduction of 1,741,00 short tons from last season's total of 19,892,000 short tons. Cane sugar producing countries showing the most noticeable changes from production in 1931—32 are Java, Cuba, India, Formosa and Porto Rico. Java and Cuba alone account for a total reduction of 2,008,000 short tons. Production in Java, according to a preliminary estimate. is placed at 1,488,000 short tons as compared with 2,821,000 short tons reported for last season's production, while Cuba's sugar crop has been fixed at 2,240,000 short tons as compared with 2,915,000 short tons produced in 1931—32· Both these countries are Members of the International Sugar Plan.

India expects to produce a record crop of 5,209,000 short tons during the present season. This shows an increase of 7,63,000 short tons over the previous record crop of 4,446,000 tons produced last season. This places India foremost among world sugar producing countries, a position which was held by Cuba prior to the restrictions imposed on production in connection with the International Sugar Plan. While India's sugar crop has exceeded Cuba in out-put, India has not entered the world Sugar Trade to the extent Cuba has. The sugar produced is of a low grade mostly consumed in an unrefined state within the country and does not enter into exports. In addition, India imports considerable quantities of sugar annually. With the increase in production, imports have fallen off considerably. India is gradually establishing modern factories for manufacturing refined sugar, which will probably tend to curtail imports in the future.

The world sugar production has shown a steady increase during the post-war period up until 1930—31 when a record crop of 31,820,000 short tons was produced. In the following year, production dropped to 29,436,000 short tons to be followed by a further decline to 26,821,000 short tons during the present season. The decrease in production during the last two years is the direct result of the efforts in crop control put forth by the countries which are members of the International Sugar Plan.

Consumption. The total world sugar consumption in 1931—32 is estimated at 29,674,000 short tons, compared with 30,394,000 short tons in 1930—31, and 29,592,000 short tons in the preceding season; this indicates a decrease of 720,000 short tons from 1930—31. Most of the decrease in consumption occured in European countries where total consumption dropped from 11,590,000 short tons in 1930—31 to 11,012,000 in 1932. Asia and Africa are the only continents which show increased consumption in 1931—32. In the case of Asia, there has been a steady increase in sugar consumption since 1924—25. At that time 6.403,000 short tons were consumed; the total consumption for 1931—32 is placed at 8,243,000. In recent years India has accounted for most of this increase in consumption.

Prices. Sugar prices continued their downward trend through 1932, but during the first few months of 1933, there has been a slight upward tendency. Sugar prices dropped steadily from 1927 to 1932. The decline during this period in the price of raw sugar at New York, was from 4·7 cents per pound, the average for 1927, to the low level of 2·9 cents for 1932, which is the lowest average annual raw sugar price on record. The low for the year and the lowest on record was in March and April 1932, when the average monthly price was 2·6 cents per pound. Raw sugar prices at *Havana*, Cuba, have shown a similar trend. The average annual price for 1932 was 0·72 cents per pound. This is the first time on record that the average annual raw sugar price has fallen below one cent. per pound.

(*From Foreign Crops and Markets, U. S. A., June 5, 1933.*)

Estimates of area and yield of principal crops in India—1931-32. The following are extracts from the report of the Director General of Statistics for 1931-32.

Character of the season. The monsoon of 1931 was, on the whole, well distributed but at a few places heavy rains resulted in floods causing damages to crops. Averaged over the plains of India, the total rainfall during the period was only 4% above the normal. During the retreating period, the rainfall was normal or nearly so in Burma, Assam, the North West Frontier Province, Mysore and the Punjab, but excessive elsewhere. Taking the year, as a whole, the total rainfall was within 25% of the normal except in Sind where it was in large defect and in Berar, Bombay and West Rajputana where it was in moderate excess.

Rice. Rice is generally regarded as a winter crop, being mainly harvested in December and January. It is sown in the months of May to August. There are two other varieties, comparatively of small importance, namely autumn rice [illegible] summer rice. Autumn rice is sown in May and June and harvested in Septem[illegible] and summer rice is sown in January and February and harvested in May and June. In Madras, the seasons vary greatly, the first crop being sown in April to October and harvested between September and March and the second crop sown in September to March and harvested between January and May. The total area under rice in 1931-32 for which returns has been received (which represent 97% of the total rice area of India) was 84,353,000 acres, a record area, as compared with 82,846,000 acres in the preceding year. The condition of the crop was good except in Burma, where the crop suffered considerably owing to failure of late rains. The total yield was estimated at 33,052,000 tons, as against 32,193,000 tons in 1930-31. To this figure should be added about 1,071,000 tons in respect of tracts for which no forecasts are made.

Wheat. Wheat which is a *rabi* (spring) crop in India is sown from October to December and is harvested from March to May. The total area under wheat in

1931-32 was reported to be 33,749,000 acres, which is greater than the area of the preceding year by 5%. The condition of the crop was reported to be fairly good. The total estimated yield was 9,026,000 tons which is 3% less than the yield of 1930-31. An addition of some 147,000 tons should be made to this estimated yield in respect of some other tracts (having an area of about 551,000 acres) for which no reports are made.

Sugarcane. The sugarcane crop is usually planted from February to May and is harvested from November to January. In Madras, the crop is harvested between December and May. The total area reported under sugarcane in 1931-32 was 2,885,000 acres as compared with 2,801,000 acres in the preceeding year. The condition of the crop was reported to be good The estimated yield amounted to 3,886,000 tons of raw sugar (*gur*) a record production, which is 20% above the final figure (3,228,000 tons) of the preceding year. To this figure should be added approximately 141,000 tons in respect of tracts (having an area of 105,000 acres) for which no estimates have been received.

Tea. The seeds are sown between November and March and the seedlings are transplanted when they are atleast six months old. The crop is plucked from May to December in Northern India, and from January to December in Southern India. The Provinces where tea is grown are Assam, Bengal, Bihar and Orissa, the United Provinces, Punjab, Madras, Coorg, and the States of Tripura (Bengal), Travancore, Cochin and Mysore. In Burma, tea is grown principally for comsumption as pickles. The total area under tea in 1931 was reported to be 807,400 acres as compared with 803,500 acres in the preceding year. The total production of manufactured tea (black and green) was calculated at 394,083,500 lbs. as against 391,080,800 lbs. in the preceding year.

Cotton. Cotton is grown in all the Provinces. There are two crops, namely, the early and the late; early cotton grows mainly in Central and Northern India, and late cotton in Southern and Western India. Taking both the crops together, the sowing season extends from March to August and the harvesting season from October to April. In parts of Southern India, sowings continue till December and harvesting till July. The total reported area under cotton was 23,495 000 acres in 1931—32, as against 23,812,000 acres in 1930—31. The condition of the crop was reported to be only fair. The total estimated out-turn was 4,060,000 bales of 400 lbs. each, as compared with 5,224,000 bales in 1930—31, or a decrease of 22% owing to damage caused by excessive rains.

	1930—31. 1000 bales.	1929—30. 1000 bales.
Exports	3279	3868
Mill consumption	2271	2373
Extra factory consumption (conjectual)	750	750
Approximate crop	6750	6991
Estimated in forecast ...	5224	5243

Of the total yield in 1931—32, Oomras represented 33%, Bengal-Sind 19%, Dholleras 14%, Broach 7%, Americans 6%, Coompta-Dharwars 6%, Westerns and Northerns 5%, Tinnevellies and Cambodias 3% each Comillas, Burmas, and other sorts 2%, Cocanadas and Salems 1% each.

Jute, is an autumn crop being sown from March to May and harvested in August and September. The provinces where it is grown are Bengal, Bihar and Orissa and Assam. It is also grown to a small extent in the Nepal State, but no reliable information is available from that State except the figures for export. As a result of restricted cultivation, the total area under Jute in 1931 was 1,862,000 acres which is nearly 47% less than that of the preceding year, and the estimated yield 5,542,000 bales (of 400 lbs. each), being about 51% below that of 1930. The area and yield of Jute in 1932 are estimated to be 1,899,000 acres and 5,820,000 bales, an increase of 2 and 5% respectively as compared with 1931. **Linseed**, is a *rabi* (spring) crop, being sown from August to October and harvested from January to April. The total area under linseed in all the reporting tracts in 1931–32, was 3,241,000 acres which is 8% above the final figure of the preceding year. The condition of the crop was reported to be fairly good. The total estimated yield was 411,000 tons as against 377,000 tons last year. To this figure should be added some 38,000 tons for tracts (having an area of 303,000 acres), for which no reports are made. **Rape and Mustard**, are also *rabi* (spring) oilseeds, being sown from August to October and harvested from January to April. The total area in 1931–32 was 6,131,000 acres as against 6 632,000 acres in the preceding year. The condition of the crops was reported to be fairly good. The total estimated yield (1,026,000 tons) was 4% above the final figure of the preceding year. To this figure should be added some 44,000 tons in respect of tracts (having an area of 260,000 acres) for which no reports are made.

Sesamum is mainly a *Kharif* (autumn) crop being generally sown from May to July and harvested from October to December; a *rabi* or summer variety is also grown in certain tracts. This is sown in January and February and is harvested in May to July. The total area reported under sesamum in 1931–32 was 5,481,000 acres, as against 5,618,000 acres in the preceding year. The condition of the crop was fair. The total estimated yield was 464,000 tons as against 526,000 tons in 1930–31. An addition of approximately 58,000 tons should be made to this figure in respect of tracts (containing an area of about 680,000 acres) for which no reports are made. **Castor seed**, is sown from May to July and harvested from January to February; a late variety is also grown which is generally sown in September and harvested in March and April. The total area sown in 1931–32 was estimated at 1,569,000 acres and the yield at 144,000 tons as against 1,457,000 acres with an estimated yield of 120,000 tons last year. The condition of the crop was good. **Groundnut**, is sown from May to August and is harvested from November to January. A summer variety is also grown in Madras forming about 5% of the total area under the crop; this variety is sown in February—March and harvested in July—August. The total area under groundnut in 1931–32 was reported to be 5,490,000 acres, which was 17 per cent less than that of the preceding year. The estimated yield (2,673,000 tons of nuts in stall) was also 15 per cent less than that of the preceding year. The condition of the crop was reported to be fair.

Indigo. The Indigo crop is sown from February to July and is harvested from August to November. In Madras, about 20% of the area under the crop is irrigated, being grown as a second crop on wet lands after paddy; this irrigated crop is sown in December—January and harvested in March—April. The provinces to which estimates for Indigo relate are Madras, the Punjab, Bihar and Orissa, the United Provinces and Bombay. The total reported area (52,500 acres) in 1931–32 was 18% below the final figure of the preceding year. The total estimated yield of dye was 9,900 cwts., which was 25% less than the yield of the preceding year. **Coffee** is sown and transplanted in the rainy season. The harvesting period is from October to January. The crop is practically confined to Southern India, comprising the Madras Presidency, Coorg and the States of Mysore, Travancore and Cochin. The total reported area under Coffee in 1930—31 was 160,900 acres, the yield of cured coffee therefrom being estimated at 32,973,000 lbs. The figures are, however, defective in as much as plantations of less than 10 acres are not taken into account. **Rubber.** The provinces where rubber is cultivated to an appreciable extent are Burma, Madras, Coorg and the States of Mysore, Travancore and Cochin. The total area under rubber in 1931 was 183,000 acres, as against 192,500 acres in the preceding year. The total yield of dry rubber was 20,417,100 lbs. as against 24,351,500 lbs. in 1930.

Correspondence.

Insect Pests of Pomegranate and Coconut and Dwarf Varieties of Coconut.

Mr. K. R Subramania Ayyar writes from Salem: Please be kind enough to get me expert opinion on the following:— 1. In a pomegranate garden, what remedies are to be applied against worms entering the ripe fruits? I have tried potters ashes, tied cloths with no good results. 2. What remedies are to be applied tó young coconut plants against beetles entering into the new stem? 3. Wherefrom I can get good quality coconut plants which may yield crop in 5 years and what would be the cost?

We publish below answers to the above queries, kindly supplied by the Government Entomologist and the Oil Seeds Specialist. 1. The damage is due to the young of a buish brown butterfly. This butterfly lays eggs on ripening fruits and the young ones hatching from the egg burrow into the fruits and damage the same. To prevent egg laying covering the growing fruits *at a very early stage* with loose muslin or paper covers so as to prevent the butterfly reaching the fruit to lay eggs has been found very effective in most places. The young fruits can also be sprayed with a deterrent mixture like Bordeau-mixture or crude oil emulsion. Further details re. this may be had from the articles on garden insects in the current Villager's Calendar. 2. The article on 'Coconut beetles' contains the current necessary information. 3. The dwarf types of coconuts will yield in about 5 years if they are regularly and sufficiently watered. They cannot be successfully grown where plenty of water is not available for the palms. The nuts of these dwarf plants can be obtained from Chowghat Taluk, Malabar District. The seed nuts would cost about Rs. 5 per 100. It may be possible to get seedlings at a rate of about Rs. 10 per 100 through the help of Deputy Director of Agriculture, VII Circle, Tellicherry.

These palms may yield 100—200 nuts per year if properly cared for. The nuts will be small and the copra from these nuts would be of low quality. The life of the palm would be between 30 to 40 years.

Review.

World Rice Situation. Reprints from Foreign Crops and Markets. Issued by the Foreign Agricultural Service Bureau of Agricultural Economics, United States Department of Agriculture, Washington June 19, 1933.

The estimated world production of cleaned rice in 1932-33, exclusive of Russia and China shows a reduction of a little less than 2 per cent from 1931-32 but is about 1·5 per cent above the previous 10 years average. India's production, 668·667 million pounds, nearly half the world's production, has been the smallest since 1927, but this has been partially offset by increases in Japan and Phillipines. Production in European countries is little different from that of 1931-32 season. There are indications of the expansion of rice industry in Brazil, which has become a competitor with United States in the Latin-American rice markets. There is a great increase in area and production in Java, due to the restriction in sugarcane industry. Despite the increased outputs, imports of cheaper rices from southern area increased, and this brought about official intervention in the form of restricted imports.

Among the chief rice-producing countries of the East, India shows a little decrease in the area covered than the previous year, while there is an increase in countries like Siam and Phillipines. Otherwise there is very little change in the average in these countries; but Japan, Korea and Formosa have increased their production by nearly 8 per cent of the production in 1931-32. In spite of this, Japanese imports of rice, mostly from Siam and United States, increased because of the anticipated smaller rice crop in the next season. Imports from the United

States consists mostly of broken rice used for flour making and distilling. In the principal South-Asiatic exporting countries like Burma, Siam, and Indo-China, the trade reports indicate continued exportable surplus of 9 per cent more than the actual exports of 1932. The large share of these rices goes to non-European countries. The latest government estimate of Burma rice available for export for 1933 is placed at 3,S64,000 short tons as against the actual exports of 3,399,000 short tons last year. The movement of rice from Burma to India proper, is on the increase during the past five years. Next to India proper, Ceylon and Strait Settlements are the leading countries of destination in the Indian rice export trade The greater part of the Indian export rice originates in Burma with relatively insignificant quantities from Bengal, Madras and other provinces. The trade with China comes next in importance, followed by Germany and Netherlands. A considerable volume of Burma rice reaches Cuba annually, while Java also has a fairly prominent position in the trade. Exports from Siam are mostly to Australia, Straits and China, while those from French Indo China show an increased movement to Europe, as a result of official efforts to increase the consumption of colonial rice in France.

Among the European countries, there was a decline in the sales of American rice in foreign countries which has been brought about by the specially low purchasing power of the principal rice importing countries Supplies in the exporting countries of Asia have been large and prices of rice in these countries have been at low levels. This situation accounts for the fact that many of the large rice-importing countries have increased their total imports of rice, while at the same time they were decreasing their purchases of American rices. Imports of American rice in the United Kingdom declined about 60 per cent, compared with the corresponding period last year, while during the same period, imports from British India, chiefly from Burma increased about 30 per cent over those of last year, and were about 40 per cent compared with average, (N. P.)

ASSOCIATION OF ECONOMIC BIOLOGISTS, COIMBATORE

A meeting of the association was held in the Freeman Hall on the 20th July afternoon when the following two papers were presented. (1) Some introduced weeds of South India by Messrs. C. Tadulingam and G. V. Narayana; (2) A Haploid plant in rice by Messrs. K. Ramiah, N. Parthasarathi, and S. Ramanujam.

The first paper gave a short account including observations on their habit, habitat and propagation of 20 species of foreign weeds, mostly natives of tropical America introduced into S. India either wilfully, or unintentionally, during the past 150 years, and stressed the necessity of detecting these in the early years of their introduction, and taking effective steps for their eradication, as otherwise they would get beyond control and prove a great menace. The systematist with his intimate knowledge of the native flora could spot out the new comers and render a great help in suggesting control measures to keep them down All the weeds described were illustrated with lantern slides. At the end of the paper a lively discussion ensued in the course of which it was suggested that in determining the original home of the species attention should be paid to localities, where, a diversity of species nearly related to the one in question, exists.

The second paper dealt with the morphology and cytology of a haploid plant in rice that arose spontaneously in association with a diploid from one of the seeds of a pure culture, which exhibits the phenomenon of polyembryony among its population, roughly in the proportion of 1 : 1000. The plant was described as dwarfed in stature, with considerable reduction of floral organs, and was marked by absence of anthesis and hence complete sterility. The various irregularities met with in its microsporogenesis, which was followed from diakinesis to tetrad formation were described and compared with those in haploids of other plants that have been recorded. The origin of the haploid was discussed to the effect, that, it is perhaps due to the development of one of the reduced cells in the embryo sac, other than the egg cell. The paper was illustrated with lantern slides and evoked a small discussion at the end when a few questions were asked and answered.

College News & Notes.

Welcome to Freshers. On the 11th. inst. the students of the ii and iii B.Sc. classes welcomed the students of B. Sc. i and the newly instituted short course. The function began with tea, which was followed by amateur music, after which the representatives of classes ii and iii and a number of lecturers, tutors, games coachers and the Secretary, M. A. S. U. made speeches welcoming the new students and initiating them into the life of the College. The representative of the new batch suitably responded and with a few words of advice to the students by Rao Bahadur C. Tadulingam, the Principal, the pleasant function came to a close.

Games. Football. The College entered for the Abraham Memorial Tournament run under the auspices of the Coimbatore Athletic Association. In the opening game we were pitted against the London Mission High School who eventually won the tournament. Though we lost the match by three goals to two. our boys gave a very good account of themselves.

Cricket. The College has entered for the Y. M. C. A. Cricket Tournament and as holders of the Rondy shield, are defending the title this year. Our opening game was against the Government College who winning the toss elected to field. We made 238 runs for 5 wickets and declared. Shiva Rao 50 (not out) Thomas 45, Suryanarayanamurti 43, Ananda 38, and Ramanatha Rao (not out) were the chief rungetters. The Government College were dismissed cheaply for 93 runs of which Chockalingam contributed 36, and Krishnaswami 25. In their second venture they were again dismissed for 50 runs, (Krishnaswami 18), so that we won the match by an innings and 95 runs.

Hockey. Our hockey team is gradually getting into strides. In a friendly match played against a strong local combination we lost the game by 3 goals to 1 but in a return match we showed better form and drew at 1 all. It is hoped that with strenous practice, our team will show all-round improvement by October, when we shall compete for the Coimbatore Hockey Tournament.

College Day. Owing to the inability of Sir T. Vijayaraghavachariar to come down to Coimbatore early in September, the College Day and Conference have been postponed to October. Preliminary arrangements are however in progress and the entertainment committee is busy with rehearsals of the dramas to be staged on the occasion.

Visitors. Rao Bahadur D. Ananda Rao the Headquarters Deputy Director of Agriculture, visited Coimbatore towards the end of August to inspect the work of field investigators employed by the Imperial Council of Agricultural Research in the district of Coimbatore. Dr. J. D. Darlington, Cytologist, John Innes Horticultural Institution, London, and Dr. E. K. Janaki Ammal, Professor of Botany. at the Maharaja's College, Trivandrum, visited the Imperiial Sugarcane Breeding Station and the Research Institute during the middle of August. The Associafion of Economic Biologists was "At Home" to the distinguished guests on the 13th August. After tea Dr. Darlington gave a very interesting lecture on "Chromosomes and Plant breeding" which was largely attended.

Personal. Dr. J. R. Seshadri, soil physicist who was appointed as Assistant Professor in the Andhra University left for Bezwada on the 2nd of August. Information has been received that Mr. S. Kasinathan who was deputed for higher studies in England by the Indian Central Cotton Committee, has taken the degree of Ph. D. in Chemistry at the London University. Dr. Kasinathan will be returning to Coimbatore by the end of August. Mr. T. R. Narayanan who was deputed by the same organisation for training in Plant Physiology has taken his B. A. (tripos) at the Cambridge University, and will be spending another year there. Mr. M. Sanyasi Raju who was on leave out of India for purposes of higher study, is understood to have taken the M. Sc. degree in Bacteriology at the University of Iowa (U. S. A.) and will be returning to India soon. It is a matter of great satisfaction that a good number of the subordinate staff of the Research Institute are going out of India for higher studies which will benefit them and their country.

Promotions.. At long last, the long-expected grade promotions in the Subordinate Services have been ordered and the announcement has considerably relieved the strain imposed by long stagnation in several grades on the one hand and the cuts in salary on the other.

Weather. Despite the heavy monsoon experienced on the West Coast and the floods in the Circars, Coimbatore had only about 2 5 inches of rain since June 1st. Though the monsoon breeze was stronger than usual and our tanks are all full from rains received on the ghauts, the fate of the dry crops on the plateau is still in the balance. Cholam usually sown in July, is in most places still in the seed store and the few enterprising farmers who have sown their seed in anticipation of rain are providing food for the population.

Weather Review (JULY—1933)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	6·2	+0·1	17·2
	Berhampore *	10·3	+3·0	25·0
	Calingapatam	13·6	+8·0	21.2
	Vizagapatam	4·8	+0·5	8·7
	Anakapalli *	7·4	+2·4	19·6
	Samalkota *	5·0	- 2·4	14·5
	Cocanada	7·4	+ 1·4	11·6
	Maruteru *	12·3	+ 4·9	19·6
	Masulipatam	10·2	+ 4·0	16·9
	Guntur *	...	...	...
Ceded Dists.	Kurnool	2·3	- 2·5	9·1
	Nandyal *	...	...	...
	Hagari *	2·2	+1·2	5·4
	Bellary	2·3	+0·6	10·6
	Cuddapah	4·4	+0·4	8·2
	Anantapur	2·9	+0·7	8·8
Carnatic	Nellore	1·6	- 1·0	3·5
	Madras	1·1	- 2·7	4·8
	Palakuppam *	0 3	- 1·2	12·4
	Palur *	2·8	-0·2	20·8
	Cuddalore	3·2	+ 0·1	17·4
Central	Vellore	1·6	- 3·1	4·7
	Salem	2·9	- 0·6	12·9
	Coimbatore	1·2	- 0·2	8·1
	Coimbatore Res. Inst. *	1·1	- 1·9	10·1
	Trichinopoly	1·2	-0·3	8·1

Division	Station	Actual for month	Departure from normal	Total since January 1st
South	Negapatam	0·8	- 1·1	9·7
	Aduthurai *	0·4	- 1·1	8·8
	Madura	2·3	+0·4	10·9
	Pamban	0·2	- 0·7	4·2
	Koilpatti *	1·0	+0·2	6·5
	Palamkottah	1·9	+ 1·6	13·6
West Coast	Trivandrum	11·5	+ 4·1	81·3
	Cochin	21·3	- 1·0	103·1
	Pattambi *	29·7	+ 4·8	94·3
	Calicut	29·6	- 0·1	117·4
	Taliparamba *	59·4	+ 11·4	127·5
	Kasargode *	50·5	+ 13·9	121·6
	Nileshwar *	52·2	+ 17·7	124·0
	Mangalore	63·8	+ 25·8	116·1
Mysore and Coorg	Chitaldrug	3·2	+0·1	11·7
	Bangalore	5·7	+ 1·6	16·5
	Mysore	5·5	+3·0	18·6
	Mercara	40·5	- 1·2	95·4
Hills.	Kodaikanal	4·8	+0·5	29·9
	Coonoor *	2·4	- 1·3	21·0
	Kallar *	...	...	...
	Ootacamund *	4·6	- 0·7	25·0
	Nanjanad *	5·2	- 7·1	24·9

* Stations of the Agricultural Dept.

Summary of general weather conditions: The monsoon was active on the west coast almost throughout the month, and in the Circars during the latter half of the month, it was weak over the rest of the peninsula. Between the 21st and the 23rd owing to an abnormal pressure distribution over the Bay and the adjoining regions, widespread thunderstorms occurred over the south of the peninsula.

The weather in the Bay was disturbed off the Orissa-Circars coast on the 14th. The disturbed conditions passed inland as a low-pressure wave and developed into a depression over South Bengal and moved westwards. Another depression formed at the head of the Bay on the 24th and moving in a westerly direction crossed the Orissa coast on the 26th and merged with the seasonal trough of low pressure by the next day. A third depression formed off the Orissa-Circars coast on the 30th and lay centred near 17½° N and 87° E. It moved in a northwesterly direction and on the 31st lay 100 miles to the south east of Gopalpore. The three disturbances gave rise to widespread and locally heavy rain over the region extending from the Konkan to the Circars coast.

Rainfall was in large excess in the Circars, South Kanara and North Malabar, in slight to moderate excess in the Deccan and Mysore, and was in defect elsewhere, being markedly so in the Carnatic and central districts. The chief falls reported being: Mangalore 7·7", 8·3", 6·1" and 8·7" on the first four days of the month, Peermade 9·4", Calicut 6·5" and Ankamali (Travancore) 7·5" on the 1st.

Day temperature was generally above normal on the coromandel except during the last week, Nellore recording a maximum of 103° on the 23rd, and maxima of 100° and above on 12 days. Temperature was markedly below normal on the Circars coast during the last week when rainfall was general.

Weather Report for the Research Institute Observatory: Report No. 7/33.

Absolute maximum in shade	93·0°
Absolute minimum in shade	70·0°
Mean maximum in shade	87·0°
Departure from normal	+ 0·8°
Mean minimum in shade	72·6°
Departure from normal	+ 0·6°
Total rainfall	1·05"
Departure from normal	- 1·94"
No. of rainy days	4
Heaviest fall in 24 hrs.	0·28"
Mean daily wind velocity	7·2 M.P.H.
Departure from normal	- 2·2 M.P.H.
Mean humidity at 8 hrs.	70·8%
Departure from normal	- 2·0%
Total hours of bright sunshine	166·0
Mean daily hours of bright sunshine	5·4

General weather conditions: The monsoon was active at the beginning of the month, but was weak thereafter till the 25th. Thunderstorms occurred in the vicinity of the observatory between the 22nd and the 26th but rainfall was light. Day temperatures were markedly above normal between the 9th and the 25th with the weak monsoon, but slightly above normal for the whole month. Skies were generally heavily clouded and humidity about normal.

P. V. R. and T. S. L.

Departmental Notifications.

I Circle. T. V. Krishnaswami Rao, A D. Sompeta the period of absence from the 20th to 30th June treated as l. a p. H. Narahari Rao, A. D., extension of l. a. p for fortnight in continuation of leave already granted. D. Bappaya A. D., Tadepalligudem, l. a. p. for 15 days from 25—6—'33. D. Hanumantha Rao, A. D., Kothapeta, extension of l. a p. for 4 days from 19—7—'33. P. Lakshminarayana, A. A. D., Narasapur. l. a p on m. c. for one month' from 13—7—'33. M. Satyanarayana. A. D. l. a. p. on m. c. for one month from 14—7—'33. T. V. Krishnaswami Rao A. D. Sompeta, l. a. p. on m. c for 2 months. T. Natarajan F. M. Samalkota, l. a. p. for 10 days from 4—6—'33 **II Circle.** V. Ratnaji Rao A. D. Naidupet, l. a. p. for 16 days from 15—8—'33. M. Krishnaswami, A. A. D. Kudligi, l. a. p. on m. c. for 6 months from the date of relief. **IV Circle.** T. V. Srinivasacharlu, A. A. D. Conjeevaram, l. a. p. for 10 days from 10—7—'33. S. Rama Rao, A. D. Chittoor, l. a p. for 15 days from 25—7—'33. M. Gopalan Unnithan A. D. transferred to Vellore Division. S. Kuppuswami Iyengar from Vellore to Saidapet. P. S. Vengasami Iyer A. D. Marudandagam will hand over charge of Saidapet sub-circle to S. Kuppuswami Iyengar. T. V. Srinivasacharlu A. A. D. Conjeevaram extension of l. a. p. for 12 days from 20—7—33. **VI Circle.** M. C. Menon A. D. Ambasamudram, l. a. p, for 11 days from 5—7—33 **VII Circle.** P. Kesavaunni Nambiar A. D. Calicut, l. a. p. for 2 months from 18—7—33. K. Soopi Haji, A. A. D. Kasargode, extension of l. a. p, for 5 days from 22—7—33. **VIII Circle.** P. K. Kameswara Menon, A. D. Erode, l a. p. on m. c. for 18 days from 21—7—33. **Principal's Office.** V. T. Subbiah Mudaliar, l a. p. for 13 days from 26—6—33. S. Ramaswami Raju, Sub Assistant, l. a. p. for 15 days from 19—6—33 **Paddy Section.** M. K. Venkatasubrahmaniam, Assistant, l. a. p. for 26 days from 24—7—33. S. Dharmalingam Mudaliar Assistant, l. a p. for 10 days from 24—6—33. V. M. Ramunni Kidavu. F. M. Pattambi, l. a. p for 11 days from 25—7—33. M. P. Sankara Nambiar, F. M. Pattambi, l. a. p. for 12 days from 19—6—33. **Cotton Section.** P. Abraham. Assistant, l. a. p. for 10 days from 29—6—33. and extension of l. a. p. for 15 days in continuation. S. M. Kalyanaraman, l. a. p for 15 days from 7—7—33. and extension of l. a. p. for three weeks in continuation. **Mycology Section.** C. S Krishnaswami, Assistant, l. a. p. for 8 days from 23—6—33 and again for one month from 10—7—33. **Chemistry Section.** T. Varahalu, Assistant l. a. p. for 6 days from 12—6—33. **Entomology Section.** Dr. C. J. George, l. a. p. for 4 days and half average pay for 8 days in continuation. **D. A's office orders** P. Kunhiraman Menon will be considered to have been officiating as assistant in the Chemistry Section from 13th April, 1933; E. R. Gopala Menon, Temporary Assistant, Entomologist, will be considered to have reverted to his permanent appointment as Assistant in the Entomology Section from 16th May 1933 and to have availed the leave granted to him for 2 months and 15 days from that date. V. Margabhandu should be relieved in the Entomology Section to report himself for duty to the Cotton Specialist. The appointment of Muhamad Moinuddin as officiating assistant in the Entomology Section will commence from the date of E. R. Gopala Menon availing the leave till 19—6—33. John A. Muliyil granted leave for two years from 1—8—33. There are 34 Permanent vacancies in the Madras Agricultural Subordinate Service, Class I, V grade as detailed below:— 1. Posts sanctioned in G. P. No. 642 Micc Development. dated 2nd April 1928. Agricultural Section (11). 2. G. O. No. 937 Development dated 25th May 1929. Science Section (7) G. O. No. 1041 M. S. Development dated 20th June 1929.2 (Millets) 3. G. O. No. 775 Mis. Development dated 5th April, 1930. 1 (Cotton Section) 4. G. O. No. 747 Ms. Development dated 4th April 1930; with effect from 1st August 1930; (Agricultural Section) 1. 5. Due to retirement of Mr. Raman from 20th September 1931. (Vacancy in the III grade) (Agricultural Section.) 1. 6. Due to retirement of Arogyaswami Pillai f. m. Vacancy from 1st April 1932 in the III grade (Agricultural Section.) 1. 7. Due to retirement of P. A. Raghunathaswami Iyengar from 1st September 1932, Vacancy in the III grade 1 (Chemistry.) 8. Due to the death of late Mr. M. K. Nambiar 1 grade vacancy from 7th December 1932. Vacancy in the III grade. 1. 9. Posts sanctioned in G. O. No. 937 Ms, Development dated 25th May 1929 in the Oil Seeds Section from 1st April 1933·1. These 34 posts were declared temporary with reference to G. O. No. 542 Public (Services) dated the 8th April 1932 in G. O. No. 311 Public (Services) dated 13th April 1933. The following transfers of upper subordinates in the V grade are ordered to take effect from 13th April 1933. N. K. Thomas, Assistant, Millet Section, to Agricultural Section. M. Royappa Pillai, Assistant, from Agricultural Section to Science section as assistant in Millet—permanent, but to continue in the Paddy Section. K. Narayana Nair, Offg. Assistant, Millet Section, to continue in the same section. S. Madhava Rao Assistant, Oil Seeds Specialist's Section, to Agricultural Section. C. R. Seshadri, from Chemistry Section to Oil Seeds Specialist Section. T. S. Lakshmanan from Agricultural Section to Science Section as Assistant in the Chemistry. R. Krishnamurti, Assistant in Oil Seeds to continue to officiate as Assistant in Cotton. K. Kumaraswami Chetty, Offg. Assistant, Oil Seeds Specialists Section to officiciate in the same section. L. Neelakantan, Assistant in Paddy to be Assistant in Cotton. P. N. Krishnaswami, Assistant in Cotton to be Assistant in Paddy but to continue in Cotton Section. M. Narasimham Assistant in Cotton to continue to Officiate in Paddy. M. C. Menon F. M. Hosur to VI Circle. V. Karunakaran Nair, A. D. Ambasamudram to Live Stock, Hosur. M. Satyanarayana, Assistant Lecturer in Agriculture to I Circle for District Work. P. A. Venkateswara Iyer, A. D. Palghat to Agricultural College, as Assistant Lecturer in Agriculture. A. Chinnathambi Pillai, Offg. Assistant Director of Agriculture, Guntur, on reversion to the Madras Agricultural Subordinate service on the 28th June 1933 is posted to II Circle. P. Vishnu Somayajulu, Assistant, I Circle, l. a. p for 4 months from the date of relief. P. Panduranga Rao, Millet Section, Coimbatore, is temporarily transferred to A. R. S. Hagari. L. Krishnan, whose Offg. appointment terminates on the 2nd July 1933 will continue to officiate from 3rd July 1933 to 19th August 1933. T. K. Mukundan whose Offg. appointment terminates on the 6th July will continue to officiate from 7th July 1933 to 5th October 1933 The resignation tendered by Dr. C. J. George of his appointment as Assistant is accepted with effect from 22nd June 1933. S. Madhava Rao, A. D. is temporarily transfered to Science section to officiate as Assistant in the Millet Section. H. Narahari Rao, poultry trained assistant, Live Stock Research Station, Hosur will proceed to Tiruvellore, Chingleput District. He will arrange for the survey of area and examine the possibilities of introducing the poultry keeping in the area. He should arrange for supply of poultry and eggs He should make arrangements for construction of sheds fencing etc. through the agency of local Agricultural Association. A class may be held in the area at a suitable time when students are arranged to attend. M. J. David, whose Offg. appointment as Assistant terminates on 15th July 1933 is appointed to officiate as upper Subordinate, Agricultural Section, with effect from 16th July 1933 till further orders. He should report himself for duty to the Dy. Director of Agriculture V Circle, Trichinopoly. The Indian Central Cotton Committee have sanctioned training grants to the following members of the Madras Agricultural Service. S. N. Venkatarama Iyer, Assistant Cotton Section, Nandyal, for training in Cotton Statistics for one year under Prof. P. C. Mahalanobis M. A. of Presidency College, Calcutta. C. Jaganatha Rao, Assistant, Cotton Section, Nandyal, for a period of one year for training in the Cotton Physiology under Dr. T. Ekambaram, Lecturer, Teachers' College, Saidapet. The training will commence from 10th August 1933. M. P. Sankaran Nambiar, F. M. Pattambi transferred to Calicut as A. D. P. Kesavanunni Nambiar,

A. D. Calicut, as F. M. Pattambi. E. R. Gopala Menon, Assistant, on return from leave is posted to work in the VII Circle, Tellicherry. The Central Cotton Committee have sanctioned a scheme for carrying out selection work on Nandan Cotton grown in the Coimbatore and Salem Districts, for 5 years. K. L. Rama Krishna Rao permanent Upper Subordinate and Offg. Assistant in the Cotton Section is posted to work on the scheme. He will work under the orders of Cotton Specialist. M. Subbiah Pillai, Offg. Assistant Paddy Section is confirmed as Assistant in the V grade in the Entomology Section with effect from 22nd June 1933. Mohammad Moinuddin whose Offg. appointment as Assistant in the Entomology Section terminates on 30th July 1933 will continue to officiate as Assistant in the Entomology Section. L. Neelakantan, Assistant, Cotton Section, Coimbatore transferred to Nandyal. The following promotions are ordered in the Upper Subordinate Service, Science section with effect from 13th April, 1933. **From II grade to I grade.** T. R. Ramasubrahmania Iyer, Assistant in Chemistry. C. V. Ramaswami Iyer, Assistant in Chemistry. P. N. Krishna Iyer, Assistant Lecturer in Entomology. **From IV grade to III grade.** D. Marudaraja Pillai, Assistant in Mycology. Samuel Jobitharaj, Assistant in Paddy. **From V grade to IV grade.** V. K. Subrahmania Mudaliar, Assistant in Cotton. M. Suryanarayana, Assistant in Chemistry. S. N. Venkataraman, Assistant in Cotton. **Agricultural Section. From II grade to I grade.** V. S. Narayanaswami Iyer, S. Narayana Ayya. L. Narasimha Charya. **From IV grade to III grade.** A. Gopalakrishna Ayya Naidu, A. Gopalan Nair. **From V grade to IV grade.** S. Kuppuswami Iyangar, P. Abisheganathan Pillai, T. G. Muthuswami Iyer, S. R. Srinivasa Iyangar, M. Subrahmania Pillai, A. Venkatarangam, K. K. Raghavan, A Chidambaram Pillai, M. P. Sankaran Nambiar, K. G. Sankappa Bhandari, K. L. Ramakrishna Rao, V. Atchyutha Rammaya, N. Subrahmania Iyer, N. Ramadoss Pantulu, K. Jagannatha Rao, E. K. Govinda Nambiar, R. Vasudeva Rao Naidu, S. Krishna Nayak, N. Srinivasa Rao, G Sakharama Rao, C. S. Seshagiri Iyer, V. K. Kunhunni Nambiar, K. Rama Rao, K. Srinivasa Acharya, K. S. Krishnamurti Iyer, K. Gurumurti, K. S. Ramanna Rai and M. Chinnaswami Naidu.

ADDITIONS TO THE LIBRARY DURING MAY 1933.

A. Books.

1. *Van Harreveld (C. H.) tr. by Pendleton* (1932) Properties of Sugarcane Soils of Java. 2. *G. D. Ciyde* (1929) Measurement of Irrigation Water (Utah Agri. Expt. Stn. Bull. 77). 3. *Parshall (R. C.)* (1932) Measuring Water in Irrigation Channels (U. S. Agri. Dept. Far. Bull. 1683). 4. *Fred (E B.) and others* (1932) Root Nodule Bacteria and Leguminous Plants. 5. (1933) Sir Profulla Chandra Ray—70th Birth day Commemoration Volume. 6. *Williams (C)* (1928) The Story of the Hive: A Bee Lover's Book 7. *Kropotkin (P)* (1907) Fields, Factories and Workshops. 8. (1932) Index to the Publications of the United States Department of Agriculture—1901–1925. (For reference in the Library).

B. Reports.

1. Third Annual Report of the Executive Council of Imperial Agricultural Bureau—1931–1932. 2. Report of the Imperial Bureau of Soil Science for the year ending March 31st, 1933. 3. Twenty-seventh Annual Report—31st December 1931 of the British Cotton Growing Association. 4. Annual Report of the Department of Agriculture of the Province of Ontario—1931. 5. Annual Report on the Agricultural Conditions of the Colony and the work of the Department of Agriculture for 1931 of the Colony of Mauritius. 6. Experimental Station Reports of the Institute of International D'Agriculture—1931. 7. Report on the

Agricultural Experiment Stations—1931 of the United States Department of Agriculture. 8. Annual Report of the Department of Water Supplies and Sewage Disposal—July 1, 1930—June 30, 1931 of New Jersey Agri. Expt. Station. 9. Review of the Sugar Industry of India during the official year 1931–32. (Supp. to Ind. Trade Jrl.). 10. Tour: Iraq to the Sudan—1932 by Sir William H. Himbury. (British Cotton Growing Association Pub). 11. Tour in India by Sir William H. Himbury. (British Cotton Growing Association Pub.)

C. Bulletins, Memoirs Etc.

12. The Use of the Antimony Electrode for Determining Soil Reaction. *Punjab Irr. Res. Inst. Memoirs, Vol. IV. No. 4.* 13. The Planting and Early Care of Young Fruit Trees. *United Provinces Agri. Dept. Bull. 1, Fruit Ser.* 14. The Dispersion of Soils in Mechanical Analysis. *Imp. Bur. Soil Sci. Tech. Com. No. 26.* 15. Recent Research on Forage Crop Cultivation, Fodder Conservation and Utilization, at the Animal Breeding Institute of the University, Konigsberg. *Imp. Bur. of Plant Gene. Herbage Plants Bull. 8.* 16. Vernalization or Lyssenko's Method for the Pre-treatment of Seed. *Imp. Bur. Plant Genetics Herb. Plant Bull. 9–1933.* 17. The Bursate Lungworms of Domesticated Animals. *Imp. Bur. Agri. Paras. Pub. 1933.* 18. Table Poultry Production with a Section on Battery Brooding. *Eng. Min. Agri. and Fish. Bull. 64.* 19. The Production, Care and Handling of Milk and Cream. *Union S. Afr. Dairy Res. Ins. Bull. No. 113.* 20. Panama Disease of Bananas in Jamaica. *Jamaica Dept. Sci. and Agri. Microbio Bull. No. 1.* 21 Field Experiments with Sugar Cane, 1931–32. *British Guiana Agri. Dept. Sugar Bull. No. 1.* 22. The Control of Asterolecanium (The Fringed Scale of Coffee). *Kenya Dept. Agri. Bull. No. 23 of 1932.* 23. Banding for Coffee Mealy Bug Control. *No. 24.* 24. Stills for the Production of Essential Oils. *No. 25.* 25. Silos, Ensilage and Silage. (The Importance of Silage as a Stock-feed. *No. 26.* 26. Report on the Economic Results of the Commercial Side of the Farm during 1931. *No. 27.* 27. Observations on Some Pasture Plants in Kenya (with suggestions for the extended trial of certain grasses. (Grassland No. 1). *Kenya Dept. Agri. Bull. No. 1 of 1933.* 28. Trials of Cash Crops and Green Manure Crops in the Nakuru and Kitale Areas during 1932. *No. 2.* 29. Maize Yields and Green Manuring, 1932. *No. 3.* 30. The Control of Antestia in Wetter Districts (Notes on a Paraffin-Pyrethrum-Soap Emulsion Spray). *No. 4.* 31. Transactions of the Texas Academy of Science 1930 to 1931 together with the Proceedings for the same time. Chlorophyil deficiencies induced in cotton (Gossypium hirsutum) by radiations. *Texas Pub. Vol. XV 1932.* 32. Rural Electrification in Oklahoma. *Oklahoma A. E. S. Bull No. 207.* 33. Red Oxide of Copper as a Dust Fungicide for combating Damping-off by Seed Treatment. *New York State A. E. S. Bull. No. 615.* 34. Twenty-five Years of Supplemental Irrigation Investigations in Willamette Valley. *Oregon State A.E S. Station Bull. No. 302.* 35. Observations and Experiments with Blueberries in Western Washington. *Pullman A, E. S. Station Bull. No. 276.* 36. Trends in the Apple Industry. *No. 277.* 37. The Production and Utilization of Corn Grown under Irrigation in Washington (Irrigation Branch Experiment Station Division of Agronomy). *No. 278.* 38. Report on Control of Floods and Drainage of Wet Lands in the Valley of the Passaic River and its Tributaries. *New Jersey Dept. of Conser. and Develop. Pub.* 39. Organic Compounds Associated with Base Exchange Reactions in Soils. *Arizona A. E. S. Tech. Bull. No, 31.* 40. Electrodialysis as a Measure of Phosphate Availability in Soils and the Relation of Soil Reaction and Ionization of Phosphates to Phosphate Assimilation. *No. 38.* 41. Truck Crop Investigations: The Effect of Heavy Applications of Phosphorus on the Inter-Relation of Soil Reaction, Growth and Partial Chemical Composition of Lettuce, Beets, Carrots, and Snap Beans. *Virginia Truck Expt. Station Bull. No. 73.* 42 The Story of Field A of the Massachusetts Agri. Expt. Stn.: A Review of Experiments with Nitrogen Fertilizers. *Massachusetts A. E. S. Bull. No. 290.* 43.

Two Systems of Feeding Dairy Cows: High Roughage and Low Grain versus Low Roughage and High Grain *No. 291.* 44. Carbon Disulfide Emulsion for the Control of the Root-Knot Nematode. *No. 292.* 45. Water Holding Capacity of Irrigated Soils. *Utah A. E. S. Bull. No. 183.* 46. Cost Reduction in Dry-Farming in Utah. *No. 215.* 47. Twenty-eight Years of Irrigation Experiments near Logan, Utah 1902–29, Inclusive *No. 219* 48. A Quarter Century of Dry-Farm Experiments at Nephi, Utah, *No. 222.* 49. Twenty Years of Rotation and Manuring Experiments at Logan, Utah. *No. 228.* 50. Factors Related to Income and-Costs of Production on Farms in Marshall and Dekalb Countries, Alabama 1927—1929. *Alabama Polytech. Inst. A. E. S. Bull. No, 236.* 51. Morphological, Greenhouse, and Chemical Studies of the Black Belt Soils of Alabama. *No. 237.* 52. Experiments with Commercial Nitrogenous Fertilizers. *No. 238.* 53. Swine: Series on California Crops and Prices. *California A. E. S. Bull. No 523.* 54. Marketing Globe Artichokes. *No. 524.* 55 Spacing Studies with Asparagus. *No. 525.* 56. Planting Season for Sugar Beets in Central California. *No. 526.* 57. The Tank-Mixture Method of Using Oil Spray. *No. 527.* 58. The Puncture Vine (Tribulus Terrestris, L) in California. *No. 528.* 59. Verticillium Wilt of Straeberries. *No. 530.* 60. Breeding Plants of the Cabbage Group. *No. 532.* 61. The Harvesting and Handling of Fall and Winter Pears. *No. 533.* 62. Effect of Extending the Cutting Season on the Yield of Asparagus. *No. 535.* 63. The Smokiness of Oil-Burning Orchard Heaters. *No. 536.* 64. Sales Methods and Policies of the Calavo Growers of California *No. 539.* 64(a). Effect of Partial Cutting in the Virgin Stand upon the Growth and Taper of Western Yellowpine. *No. 540.* 65. Physical and Chemical Characteristics of the Soils from the Erosion Experiment Stations. *U. S. A. Agri. Dept. Tech. Bull. No. 316.* 66. Biology and Morphology of the Spindle Worm, or Elder Borer. *No. 345.* 67. Practical Information for Beginners in Irrigation. *U. S. A. Agri. Dept. Far. Bull. No. 864* 68. Breeds of Light Horses. *No. 952.* 69. Strawberry Culture: Western United Stages. *No. 1027.* 70. Beef-Cattle Production in the Range Area. *No. 1395.* 71. Currants and Gooseberries: Their Culture and Relation to White-Pine Blister Rust. *No. 1398.* 72. Bean Diseases and their Control. *No. 1692.* 73. Growing Christmas Holly on the Farm. *No 1693.* 74. Dressing and Packing Turkeys for Market. *No. 1694.* 75. Using Soil-Binding Plants to Reclaim Gullies in the South. *No. 1697.* 76. Growing Root Crops for Livestock. *No. 1699.* 77. Bacterial Diseases of Plants occurring in Formosa I. *Japan Taihoku Imp. Univ. Phytopath Lab. Contri,* No. *13.* 78. Studies on the White Pocket Rot or "Renkonkusare" of Chamaecyparis Formosensis Mats. No. *14.* 79. Early Diagnosis of Plant Diseases. No. *15.* 80. Bacterial Diseases of Plants occurring in Formosa II. No. *16.* 81. Immunological Studies of Mosaic Diseases III. Further Studies on the Distribution of Antigenic Substance of Tobacco Mosaic in different Parts of Host Plants. No *17.*

D. Circulars, Leaflets Etc.

82. The Indian Central Cotton Committee: Its Objects, Activities and Achievements. *Ind. Cent. Cott. Comm. Fub, Pamph.* No. *1.* 83. Physiology of the Cotton Plant in Sind with special reference to Perrennial Irrigation. No. *2.* 84. The Khandesh Cotton Breeding Scheme. No. *3.* 85. Green Stained Sind-American Cotton. 86. Madras Herbaceum Scheme. 87. Tackling the Impurity in Indian Cottons. 88. Campaign against Cotton Wilt Disease in C. P. Two High Yielding and Resistant Strains evolved. 89. Some Problems of Cotton Growing and its Rotation Crops in the Central Provinces and Berar. 90. War on Boll-Worm in Broach District. 91. Publications on Soil Science issued from the Empire Overseas during 1932. *Imp. Bur. of Soil. Sci. Pub.* 92. Operation of Egg Packing Stations: I. A Farmers' Co-operative Station. II. A Private Station. *Wales Agri. Dep. Econ. Pub.* 93. Wool Intelligence Notes: World Wool Situation.

1933. *E. M. B.—(Statistics and Intelligence Branch Pub.).* 94. Bark Beetles and Shot Borers. *Mini.. Agri. and Fish. Adv. Leaf.* No. *159.* 95. Rabbits for Fur and Flesh. No. *161.* 96. Angora Rabbit Wool Production. No. *162.* 97. The Onion Fly. No. *163.* 98. The Wood Pigeon . No. *165.* 99. Selection of Dairy Cattle and Milk Recording. No. *166*, 100. Hand and Machine Milking. No. *167.* 101. The House-Sparrow. No. *169.* 102. Pea and Bean Thrips. No. *170.* 103. The Cultivation of Flax for Fibre. No. *171.* 104. Earcockles of Wheat No. *172.* 105. The Gout Fly. No. *174.* 106. Current and Gooseberry Aphides, No, *176*. 107. Notes on the Cultivation of the Pineapple (Ananas Sativus), *Mauritius Agri. Dept. Leaf. Ser, Leaflet 33.* 108. Notes on Vanilla Cultivation, *Leaflet 34.* 109. Preparing Wool for Market. *U. S. A. Agri. Dept. Leaflet 92.* 110. Lamb Feeding, *N. Dakota Agri. Ext. Dvn. Cir. 114.* 111 An Inexpensive Machine for filling the Trench Silo. *Alabama A. E. S. (Poly Tech. Inst.) Cir 61.* 112. The Use of Ice in Curing Pork on the Farm. *Cir. 62.* 113. Idle Farm in Hunterdon County New Jersey. *New Jersey Agri, Dep. Cir.* 227. 114. Records of Rice Yields in Japan. *Japan Better Farming Assocn. Pub.*

E. Reprints.

115. Empire Fibres for Marine Cordage: Tests of Cordage Manufactured from Manila and Sisal Hemps. 116. Methods of Pasture Analysis. 117. Cotton Fibres—1. Origin and Early Stages of Elongation. 118. Differences in the Amino Acid content of the Chief Protein (Glycinin) from Seeds of Several Varieties of Soybean. Oil Conten of Nine Varieties of Soybean and the characteristics of the Extracted Oils. 119. A Method for Determining the Quantity of Mineral Oil Retained by Leaf Surfaces After Spraying

F. Translations

120. The Pre ent State of Investigations on Virus Diseases. 121. Sugar Formation and the Process of Ripening of Sugar Cane 2nd Contribution—On the Formation of Starc in the leaves of Sugar Cane. 122, Pennisetum Americanum, L. (X, Schum), Breeding Technique, 123, Sorghum:— The History and Distribution of Sorghum, Andropogon Sorghum, L, The Breeding Work—Pure Breeding, Hybrid Vigor n Sorghum, 124, Millets-Breeding: The Effect on Yield of the Duration of the Vegetative Period in Varieties of Millet, On the Glume Colour of Panicum Miliaceum, Investigation on Pollination in Millet, Contribution to the Study of Panicum Miliaceum Breeding Work, Panicum Italicum (L), 1, Maximum—Breeding Technique—Pure Breeding. Panicum Italicum, L, 2, Moharium (P, Germanica [Roth]), Breeding Technique,

problem as to whether he is a loser if he sells his produce in a particular market at a particular rate per unit.

By increasing the dose of manure or other treatments given at a heavy cost one ryot is able to increase his acre yield very considerably. Whether it is economical to do so is a question yet remaining unsolved. Calculating the cost of production per unit of the produce as above, will immediately warn the producer to remain within economic limits.

Therefore I suggest that calculations of the cost of production must not end with cost of production and yield per acre, but must proceed further and should be resolved into the cost of production per trade unit of any produce if the producer must know his own economic position at any stage. It is, I believe, the want of such a clear idea of the economic position that does not induce the average wet land farmer to go in for any crop other than paddy and adopt other improvements suggested by the Agricultural Department as rapidly as he should.

AGRICULTURAL METEOROLOGICAL PROBLEMS.

BY S. AUDINARAYANAN, M. A.

Agricultural meteorology deals with the influences of weather on vegetation, particularly on animal life, vegetable food and textile supplies of the nations of the world. That agriculture depends both on the climate and the periodical variations of weather is a well known fact. But the relations are very complicated and there is difficulty in separating the effects of the several factors. So much so, the progress made in applying the data in meteorology to the purposes of agriculture is not as much as might have been expected. The greatest obstacle to the progress is the great inaccuracy in the data expressing acreage and yield. The meteorologist engaged in the study of weather and crop relations is constantly confronted with the internal evidence of gross inaccuracies and lack of homogenity in acreage and yield values.

A definite advance seems to have been made by the establishment of the Agricultural Meteorological Section under the Indian Meteorological Department. Their programme of work on the Research side includes the investigation of best methods and standardisation of those methods for the measurements of radiation, evaporation, soil temperature, and soil humidity so that these data may ultimately be systematically maintained in addition to those of air temperature, air humidity, rainfall, wind, sunshine etc. The Statistical Officer under the Imperial Council of Agricultural Research is travelling from province to province and is taking every effort to improve the defects in the collection of acreage and yield statistics. But the records at the several Agricultural Farms should be very accurate to be capable of yielding very good results.

The land-owner and producer in South India are always finding fault with the high transport charges by rail etc., while none of them considers seriously as to how far, one can improve the methods so as to reduce one's cost of production.

As regards paddy cultivation, ploughing charges are saved by at least 20% by the use of improved implements which are more efficient. Cost of seed is reduced by 25% as the reduction of the quantity is found possible when improved strains of paddy are grown. No outside manure need be purchased and the manuring charges can be maintained where it was or reduced to almost nothing, if the ryot improves his ways of collecting and conserving cattle manure. This will enable him to improve the quality and increase the quantity of manure. The increase in manure supply can be about 50% and it will easily outgrow the effect of any other improvement adopted by the farmer. Taking the more prominent items alone into consideration, the position is as below:—

The increase for the improved seed alone is 10% of the yield.

The increase of yield for the better manuring is not less than 50%.

It may be manuring over a larger area or more manure in the same area when the manuring is poor. Thus easily a careful ryot can increase his income by about 60% as shown above and reduce the expenditure by 10%.

The account will be roughly as below for a Tanjore ryot :—

	Present cost.	Reduced cost.
Cost of ploughing	5—0—0	4—0—0
Cost of manure	8—0—0	8—0—0
Cost of seed	2—0—0	1—8—0
Cost of planting and thinning	2—8—0	2—8—0
Cost of weeding	2—0—0	2—0—0
Total	20—0—0	18—0—0

Harvest is paid for in kind and hence not taken into account. Value of straw has been put as a set off against the assessment. The capital invested in the price of land is left out of consideration since the profits are due to it.

To calculate cost per unit of produce, cost of production may now be put down as Rs. 20 per acre for 1700 lbs. in Tanjore. That is equivalent to Rs. 11—12—3 for 1000 lbs. Cost of production as per improved methods is Rs. 18 per acre for 2720 lbs. yield per acre; it means Rs. 6—10—0 per 1000 lbs. Reducing it per *kalam* of 64 lbs. the cost of production comes Rs. 0—12—9 per *kalam* in the old way and Rs. 0—6—9 per *kalam* under the improved system.

Calculating the cost of production per unit must be the ordinary way that a ryot should adopt. The idea of calculating cost of cultivation per acre and yield in lbs. will give him no easy solution of the problem as to whether he is a loser if he sells his produce in a particular market at a particular rate per unit.

By increasing the dose of manure or other treatments given at a heavy cost one ryot is able to increase his acre yield very considerably. Whether it is economical to do so is a question yet remaining unsolved. Calculating the cost of production per unit of the produce as above, will immediately warn the producer to remain within economic limits.

Therefore I suggest that calculations of the cost of production must not end with cost of production and yield per acre, but must proceed further and should be resolved into the cost of production per trade unit of any produce if the producer must know his own economic position at any stage. It is, I believe, the want of such a clear idea of the economic position that does not induce the average wet land farmer to go in for any crop other than paddy and adopt other improvements suggested by the Agricultural Department as rapidly as he should.

AGRICULTURAL METEOROLOGICAL PROBLEMS.

BY S. AUDINARAYANAN, M. A.

Agricultural meteorology deals with the influences of weather on vegetation, particularly on animal life, vegetable food and textile supplies of the nations of the world. That agriculture depends both on the climate and the periodical variations of weather is a well known fact. But the relations are very complicated and there is difficulty in separating the effects of the several factors. So much so, the progress made in applying the data in meteorology to the purposes of agriculture is not as much as might have been expected. The greatest obstacle to the progress is the great inaccuracy in the data expressing acreage and yield. The meteorologist engaged in the study of weather and crop relations is constantly confronted with the internal evidence of gross inaccuracies and lack of homogenity in acreage and yield values.

A definite advance seems to have been made by the establishment of the Agricultural Meteorological Section under the Indian Meteorological Department. Their programme of work on the Research side includes the investigation of best methods and standardisation of those methods for the measurements of radiation, evaporation, soil temperature, and soil humidity so that these data may ultimately be systematically maintained in addition to those of air temperature, air humidity, rainfall, wind, sunshine etc. The Statistical Officer under the Imperial Council of Agricultural Research is travelling from province to province and is taking every effort to improve the defects in the collection of acreage and yield statistics. But the records at the several Agricultural Farms should be very accurate to be capable of yielding very good results.

At Lyallpur the cotton crop is being subjected to systematic experimentation and results of a far-reaching nature are anticipated. There the results of early and late waterings are being investigated. Also work is being carried out on the causes of the partial failures of the Punjab-American cottons. A very detailed study of the reactions of the plant to various environmental factors is being made which includes an examination of the moisture content of the soil correlated with the speed with which water passes up the stem of the plant, age of the leaves on different portions of the plant relative to their size, the carbohydrates in the various tissues of the plant body and the size and weight of bolls as affected by condition of growth. Such investigations must be started at the several Agricultural Farms and the Agricultural Department must make themselves responsible for meteorological studies relating to the influence of weather conditions on the growing crop.

Temperature, rainfall and sunshine are some of the very important factors that control climate. A broad climatic belt gives the nature of plants growing and there is also a narrow belt in which certain plants will grow. There is what is called optimum combinations of temperature, moisture and sunshine in which plants make their best growth and under which largest of yields will be obtained. Food is available to the roots of the plants only in a soluble form and it is carried up the plant and converted into vegetable tissue under the influence of solar energy which is expressed in heat units or calories. Different plants require unlike proportions of moisture, heat and sunshine. Many plants have a certain period during growth when there must be a well-defined combination of certain weather factors to produce large crop-yields. To determine these critical periods laboratory experiments must be performed side by side with field observations and the several factors must be correlated mathematically from past records. Anticipation of a type of weather known to be injurious or beneficial is of paramount advantage. This line of research requires attention.

High and low temperatures affect crops in various ways. But the principal ones are prevention of germination, checking of growth, killing all or part of the vegetative parts, injuring the blossoms or damaging the maturing parts. Also there are certain definite temperatures below which a plant will make no growth. This zero of vital temperature point is 43°F or 6°C. Kincer in U.S A. has suggested that the zero of the spring-seeded crops should be the mean daily temperature about the average date of the beginning of planting. Such temperatures have been determined for the following cases.

Spring Wheat	37° to 40°.
Oats	43°.
Potatoes	45°.
Corn	55°.
Cotton	60° to 62°.

Rainfall. The problem of dealing with the entire range of rainfall from the lowest to the highest limit between which any cultivation of crop is carried on, is not a very difficult one. Though emperical grouping of factors will solve the problem, yet more advanced mathematical methods could be used for calculating and fitting regression curves which is expected to be of wider applicability and more fertile of results.

Soil. Physical circumstances and properties of the soil are of much importance to ·agriculture. Schubler has tried to find the effect of the colour of the soil on the absorption of radiated heat and the influence of moisture in the soil. A wet soil takes a longer time to warm or cool than a dry one. In permeable soils, rain carries down with it the temperature of the air and the surface layers. The relative importance of the temperature of the air and the soil upon plant growth presents difficulties. The power of the soil to retain water is important in its effect on the temperature of the soil and supply of water to the plant. Necessity of water increases with the nature of the sub-soil, the closeness of the stand of plants, size of leaves, dryness of air, velocity of wind and temperature.

Complete hydrodynamic solution of the movement of sub-soil water has not so far been obtained, but on the assumption that the velocity is proportional to the first differential of the relative saturation of the sub-soil and that the ratio of the surface of all particles per unit volume to the saturation quantity of moisture is constant, an integrable equation results for a linear change of particle surface with depth.

Sunshine. No plant life is perfected and reaches its maturity except through the influence of short wave solar energy. Dark rays of heat can replace sunlight in the growth of vegetation but sunlight can partially replace heat. Sunlight-hour-degree is the measure and is the product of the mean daily heat required to grow and mature and the possible number of hours of sunshine from planting to harvesting.

An enquiry into the relationship between meteorology and a crop or crops in any given district only shows what variations of weather are most desirable in that locality. For, in England the correlation between winter rainfall and subsequent spring crops was found by Hooker to be negative, whereas S. M. Jacob found the same correlation for the Punjab as positive. These opposite conclusions do not prove that correlation is useless but that care is necessary in scrutinising the results. It can rarely establish the standard that the crop really prefers.

The results obtained by Jacob, Wallen and others are a sufficient warrant that the method of correlation is an exceedingly powerful weapon in the hands of a crop fore-caster. It is abundantly clear that the weather plays a part invisible to the eye in the internal structure of the plant that can be measured by such statistics. These numerical records must be worked up and the results taken into serious consideration and used in conjunction with the facts such as are learned by actual observation in the fields, for fore-telling the future harvest. Far more investigation is yet required into the behaviour of different crops under different conditions of weather Though the problems are well defined yet the progress recorded has been singularly small.

In India, there is a vast store-house of valuable statistics awaiting expert knowledge and intelligent shifting. The method of correlation is by no means the only way of attack but its vitality is shown by the remarkable series of co-efficients obtained by Hooker in 1922. J. W. Smith has found the weather index of factors injurious to plant growth and finds a correlation between that index and the yield. R. A. Fisher has another method but has put his finger in a weak spot in the method of correlation. As you correlate yield with finer and finer time intervals of rainfall, the co-efficient tends to zero. Applications of statistical methods has been well recognised and what is to be considered is how far the Indian Statistics are going to throw light on the connection of weather conditions and yield.

The main sources of yield data in India are (1) the record of crop experiments by the Government revenue staff during settlement operations and routine of district administrations which gives only a discontinuous series which would not repay closer examination. (2) the record of failed crops noted by village revenue agency which if cautiously handled would give some useful result. (3) agricultural department experimental station records which are the most reliable. and lastly, and (4) the season reports of the Directors of Agriculture.

Jacob is of opinion that though fairly favourable as the conditions in India are for the study agricultural meteorology, yet for the solutions of the problems of agronomic meteorology-which concerns with the direct effect of rainfall, temperature, sunshine and winds in inducing the cultivator to bring varying amounts of unirrigated lands under the plough or of restricting or increasing the use of artificial sources of irrigation—the data provided in North India are unsurpassed in the whole world for the space and time they cover, their accuracy and continuity. The statistician who does not become the slave either of his satistical material or of his mathematical methods can obtain a clue to the variations of crop areas with variations of climate and weather. Though not well served in the side of yield statistics he will have an opportunity of helping to solve some of the world problems of agricultural meteorology..

The several methods of agricultural meteorological research are (1) Laboratory studies with plants, animals under completely controlled conditions, of the effect of different kinds of temperature, humidity, light etc. in conjunction with different soils and different kinds of nutrition. (2) Pot culture studies in which factors other than the weather are controlled and statistical methods are used to ascertain, the effect of the different weather factors. (3) Field studies in which measurements of crop growth and yield and of the intensity of attack of diseases and pests on the one hand and meteorological factors on the other are carried out side by side. Analogous studies on animals are carried out by observations of the healthy fecundity etc. of herds and flocks in conjunction with meteorological records, and (4) Statistical studies in which records of crop yields and weather over a long series of year are correlated.

Insect pests and plant diseases. Value of forecasts of seasonal appearance of insect pests and plant diseases and their mass outbreaks, and research on the relation between meteorological factors and insect activities and plant diseases, are problems that have immediate bearing on the subject.

Investigations should be carried out on the following lines. (1) Application of climograph method to studies in distribution, seasonal cycle of development and periodic fluctuation in the number of insects. (2) Effect of atmospheric motion on the distribution of insects. (3) The insect fauna of upper atmosphere. (4) Influence of the colouration of insects on their thermal economy. (5) Effects of atmospheric pressure on insect activities and development (6) Part played by light in the development of insects. (7) Determination of the distribution of the fungus spores by the winds in close co-operation with the metorologist, by the plant pathologist, and (8) Relation of weather to healthy crop growth and yield.

For each important crop plant, during the whole period of its growth and maturation, the following meteorological data should be recorded. (1) Air temperature (*a*) above the crop, (*b*) at the level of the top of the crop, (*c*) at midcrop height, (*d*) at the base, (*e*) in the soil, recorded every two or three hours or by a continuous recorder. (2) Moisture content of the land (*a*) at base near the crop, (*b*) under the crop, the usual precipitation records measured twice daily and nightly. (3) Relative humidity of the air (*a*) above the crop, (*b*) at the level of the top of the crop, (*c*) at each quarter of its height, (*d*) at the base. (4) Cloud records and sunlight intensity. (5) Relative penetration of precipitation into a crop at each degree of density and the length of time moisture remains on the foliage. (6) The relative amounts of dew deposited on crops of different heights for each stage of temperature, moisture and humidity as well as of crop density. (7) Relative penetration of wind of varying degrees of force into the crop and its relation to crop humidity, temperature and spore dispersal. (8) The humidity and temperature of the higher air strata.

and (9) More information about air currents and spore dispersal. The methods of collection of these data should be left to the meteorologist himself. The analysis of these data is a problem involving deep analytical and higher mathematical treatment.

UTILISATION OF DAIRY WASTES.*

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The subject of this paper relates to the utilisation of the waste products of the dairy and is based mainly on certain experiments conducted in 1918 with the object of investigating the possibility of manufacturing locally, food and other products which could replace similar products which used to be then and still to a large extent are imported from outside, but which war conditions had rendered very difficult to obtain.

When milk coming into the dairy could be all disposed of as milk there will be of course no waste, but where the demand for fresh milk is limited and production is considerably in excess of such demand the milk will have to be converted into cream or butter or cheese and these processes would always leave a certain amount of waste in the form of skim milk or whey. If, however, by some means these waste products could be converted into something of marketable value not only such waste could be prevented but the mother industry could be made more profitable.

Skim milk contains about 3% of the protein, casein, held in colloidal suspension. The latter is easily separated by precipitation with acids. On a large scale the separation is best effected by the addition of sulphuric acid. In the experiments referred to above, the precipitation was effected by mixing one and a half parts by volume of strong sulphuric acid with seven parts of water and adding the mixture to 1,000 parts of milk. The precipitated casein was washed, pressed to free it of superfluous water and dried in a draught oven at a moderate temperature and finally powdered as fine as possible.

A purer product can be obtained by dissolving the moist casein in the least possible quantity of ammonia and reprecipitating with acid. This process is repeated three or four times. The curd is washed several times with alcohol, extracted with ether in a soxhlet apparatus and finally dried.

Casein has been found to lend itself to an enormous number of uses in industry. The uses to which it is put is increasing year by year. There are probably very few industries in which casein does not or cannot advantageously get employed. Thus it is used in the manufacture of distempers, cardboard, paper glazing, leather dressing, soap manufacture, cotton sizing and water-proofing, calico printing, boot polishes, water proof cements, invalid foods, and imitations of bones, ivory, tortoise shell etc.

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Casein Paints and distempers. Casein prepared in the manner above described is soluble in solutions of the hydroxides of the alkali and alkaline earthy metals and in many cases of their salts as well, although the quantity of each required for complete solution is different in each case. Thus of sodium hydroxide 1¾%, sodium carbonate 2¾%, sodium bicarbonate 3½%, sodium tungstate 12½% of the casein are required for complete solution. Solutions of borax and ordinary soap also dissolve casein.

Casein similarly dissolves in lime water although to a less extent, but the casein-lime compound thus formed has the property of absorbing carbon dioxide from the air and forming an insoluble compound. It is this property of casein which lends itself to the preparation of casein paints and distempers. These consist of mixtures of casein and slaked lime along with suitable pigments. On the addition of water the casein and lime combine to form a sticky soluble product holding the pigment in suspension. When applied to any suitable surface—wall, timber, or iron, the casein-lime compound in the prepared distemper absorbs carbon di-oxide from the air forming an insoluble durable coating which does not wash or rub off.

The proportions of the various ingredients forming the mixture is important. Too little lime would tend to make the product insoluble and too much would induce the paint to come off in flakes. Similarly too little paint would make the coating brittle and liable to flake off while if too much, the paint will rub off and not stand washing. Further, not all pigments could be used in the mixture, but only those which are not affected by lime. It is, however, possible to select suitable pigments to cover a full range of colours.

White paint may be made up of 100 parts each of casein and lime, levigated chalk 800, borax 1, and ultra-marine 2 to 3 parts by weight. while coloured paints may consist of similar proportions of casein and lime 400 each of levigated chalk and pigment, and borax one part. The ingredients should be all finely powdered and thoroughly dry. The mixture when stored in air-tight boxes will keep indefinitely.

For use, 50—60 parts of water are added to 100 parts of the powder and stirred until the mass is homogenous and free from lumps. This is then covered with a thin layer of water and set aside for the space of about one hour, after which the mass is stirred with more water to the consistency of oil paint. The paint thus prepared should be used without delay as it is liable to set hard in a comparatively short time, becoming unfit for use in twelve hours. The paint which can be applied to any clean surface such as lime, plaster of paris, cement, brick, timber, stone, metal or canvas dries quickly with a mat surface and after 36—48 hours can be washed without fear and will stand the weather. The painted surface can be varnished if desired, painted or stencilled on. A glossy paint for indoor use can be produced by spraying the surface with a mixture of turpentine and wax and polishing it afterwards.

Casein adhesives. When dissolved in caustic alkalies or their salts, casein has adhesive properties and as such could be applied to the preparation of glues and cements, either liquid or solid, the solid glue only requiring to be dissolved in water for use. They find use for various industrial purposes, especially in wood work as they are ready for immediate use without previous soaking and heating as in the case of ordinary glue.

Two specimens are on exhibit, one prepared with borax and the other with soap. In one the borax serves as a preservative. The other requires the addition of an antiseptic as thymol or carbolic acid or lysol in order to preserve it.

Photographic films. Casein has been used in place of celluloid in the manufacture of photographic films, and in place of gelatin for coating the photographic plate or film, the sensitised "emulsion" in the latter case consisting of a solution of casein holding the halide salts of silver in colloidal suspension. Photographic paper similar in most respects to gelatine-chloride or bromide paper have also been prepared for printing from negatives or for enlargements.

The paper used for the specimen photographs on exhibit was obtained by coating ordinary paper with a solution of casein in citric acid to which a little glycerine had been added to give the paper the requisite pliability. The coated paper was, after drying in the shade, drawn over a 5% solution of ammonium chloride to render the casein insoluble, dried, sensitized in the dark room by floating in a 10% solution of silver nitrate and again dried in the dark room. Prints were obtained as on ordinary P. O. P., the operations of toning and fixing being also the same as with P. O. P.

Boot and shoe polishes. Casein has been found useful in the preparation of shoe and boot and furniture polishes, the casein in such preparations serving the purpose of a protective colloid holding in suspension considerable quantities of the other ingredients, usually wax or paraffin, turpentine and colouring matter. The samples exhibited have been prepared by dissolving casein in a solution of ordinary soap and incorporating with the mixture about twice the quantity of turpentine. A certain proportion of shellac dissolved in borax is also added to give the requisite gloss and finally the colouring matter which in the case of brown polishes may be an extract of annatto and in black polishes, ordinary lampblack in a fine state of division.

Alimentary Casein. Casein being the chief protein material in milk is of considerable food value and possessing as it does good keeping qualities and no objectionable taste or smell has found favour in the preparation of several alimentary products, some of these being peculiarly suited for invalids. Thus, patent foods have from time to time been placed on the market under the names, Plasmon, Eucasein, Vitafer, Sanagen, Sanatogen, etc. The composition and the process of manufacture of these are not known with certainty but from knowledge gained by their chemical analysis it is possible to imitate them closely. Thus a product similar to Plasmon which is a soda compound of casein is obtained by mixing together 80 parts of casein containing about 5% of fat, 7 parts of sodium bicarbonate and 13 parts of lactose. Eucasein, which is a casein ammonia compound, could be prepared by passing ammonia through casein suspended in alcohol and afterwards separating and drying the casein. A product closely resembling Sanatogen is obtained by dissolving casein in sodium glycero-phosphate, evaporating the viscous mass to dryness in vacuo and reducing the dried mass to fine powder. Samples of these products obtained in the manner above mentioned are on exhibit.

Casein solids – Galalith. By suitable treatment casein could be converted into a plastic mass which could be moulded or pressed into various shapes, the finished product resembling horn, ivory, or tortoise shell according to the manner of treatment. The products are known as Galalith or Lactoform. The plastic mass after being hot-pressed in hydraulic presses is hardened by immersion in a solution of formaldehyde the length of treatment varying from 2—30 weeks, according to the thickness of the articles. A variety of articles can be made from Galalith, e. g., brush backs, combs, cigarette holders, electrical fittings, umbrella and stick handles, buttons, etc. The articles thus made are uninflammable unlike celluloid.

Lactose. The whey drained off the curd in the manufacture of cheese contains most of the lactose present in the original milk and could be recovered. The method adopted consisted in first precipitating the milk albumen present in the whey by the addition of acetic acid and warming and then removing it by straining through cloth. The clear liquid was evaporated down on the water bath until the liquid showed signs of turning brown after which it was concentrated in vacuo until a syrup was obtained from which the sugar crystallised out on cooling. The first crop of crystals was quite white after having been washed in a fine spray of water. The mother liquor on treatment with bone charcoal and concentration in vacuo yielded a further quantity of brown coloured crystals.

OCCURRENCE OF STERILE PLANTS IN BENGAL GRAM (*Cicer arietinum*).

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&
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At the Cotton Breeding Station, Coimbatore, a few sterile plants (Plate I, Fig. 1) without any pods were observed in the year 1930, among the progenies of single plant selections. During 1931, their appearance was more common, and again in the following season, their percentage occurrence was as high as fifteen in certain fields sown with unselected bulk. As the presence of such a large proportion of sterile plants would considerably reduce the yield of crop, a detailed study of these sterile plants was made with regard to the modifications of their floral parts, and the causes of their occurrence.

The sterile plants (Fig. 1) had their floral parts metamorphosed or virescent, and were distinguished by their characteristically stunted and bushier habit, by the smaller and more greenish leaflets, and by the upright gynophores with empty carpels. Sometimes a plant had only a few branches, or portions of a branch displaying this abnormality. The various monstrosities observed in the flower, might now be dealt with under the various types of floral structures.

Sepals. The gamosepalous calyx was transformed into five separate stalked leaves with entire margin (Fig. 2) inserted in a radial symmetry on the receptacle. In advanced cases, each of the sepals was modified into a pinnate leaf (Fig. 3) with long petioles and serrate edges.

Petals. The corolla lost its pink colour and showed different degrees of virescence (Fig. 3). In such cases the normal Zygomorphism, and hooded character of the standard remained unaffected. In others the differentiation between sepals and petals was lost, and both whorls were metamorphosed into pinnate leaves. In a few instances there was pelory.

Stamens. The diadelphous stamens got dissociated and remained free (Fig. 3). The filaments showed either petalody (Fig. 4), or phyllody with glandular hairs (Fig. 5). The anthers were often transformed into virescent cup-like structures, but if present, they were atrophied and non-dehiscent. In extreme cases the entire androeceum showed metamorphosis into pinnate leaves. (Fig. 7).

Pistil. The most common feature was the grooved petiole-like gynophore terminating in a partially developed carpellary leaflet with a tailed midrib corresponding to the style and stigma (Fig. 2). In some cases the entire pistil had changed into a pinnate leaf (Fig. 3). The funicle showed tendencies to form a bilobed leaflet with prominent glandular hairs. The ovule too was found to be transformed into a leaf (Fig. 6).

Fig. 2.

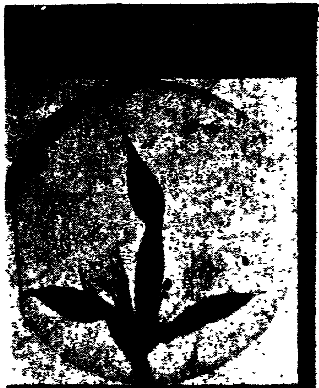


Fig. 1.

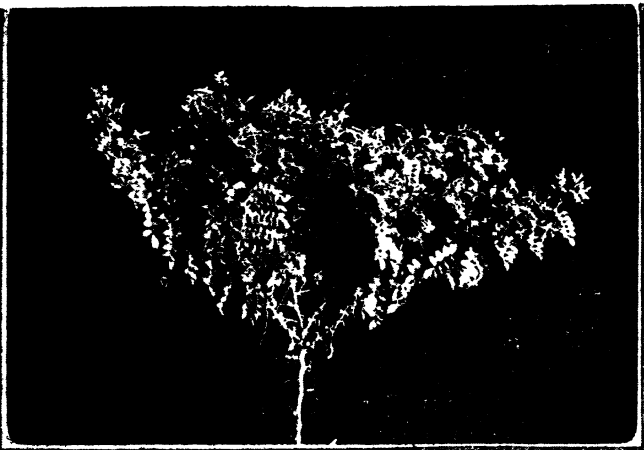
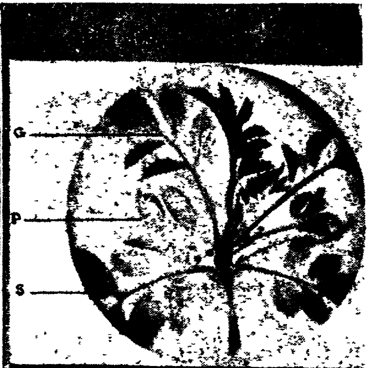


Fig. 3.



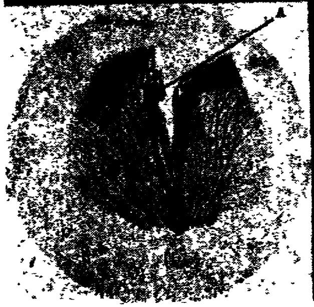


Fig. 4.

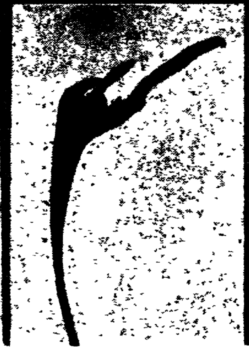


Fig. 5.

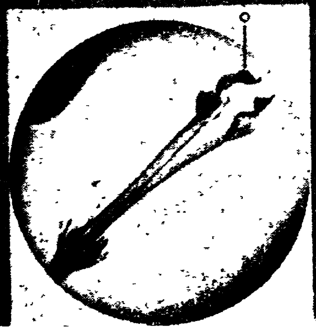


Fig. 6.

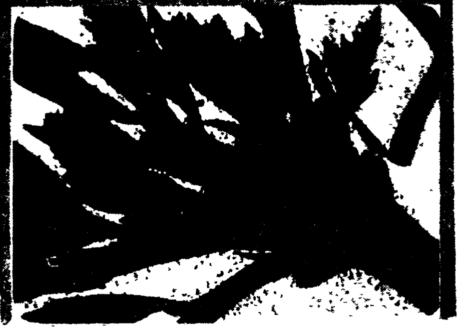


Fig. 7.

Plate I.	Fig. 1.		An abnormal plant with prominent gynophores.
	Fig. 2.	Longitudinal section of an abnormal flower.	Sepals changed to stalked leaflets, stamens free, Pistil, turned to leaf.
	Fig. 3.	Do. Do.	(S) Sepals ; modified into pinnate leaves. (P) Petals. Stamens free. (G) Pistil turned to a pinnate leaf. Shows axillary profiforation.
	Fig. 4.		Petalody of the filaments opposite to the standard. (A) Anther.
	Fig. 5.		Stamens exhibiting leafy nature: anthers showing cup-like modifications and development of glandular hairs.
	Fig. 6.		(O) Ovules and funicles showing leafly transformations.
	Fig. 7.		All floral members transformed to leaves.

In one plant an interesting monstrosity with all the various floral whorls converted into pinnate leaves (phyllomania) was met with (Fig. 7). In this case a vegetative shoot was found in the axil of the carpel, thus showing axillary proliferation.

Causes. Worsdell (1916) stated that the phenomenon of abnormalities is generally caused "under certain unfavourable conditions of climate, nourishment, or the influence of parasitism" of a fungus or an insect. Janse (1928) explains the same to be due to the disturbances produced in the quality or quantity of the growth enzymes occurring in the plant. The abnormal plants were examined by the Government Mycologist and the Entomologist, Coimbatore, and no sign of fungus or insect attack was detected. Seeds collected from such plants when sown did not produce a greater number of abnormal plants (11·7%) than was noted in the adjoining control area. The continued presence of sterile plants in crops raised during all the three years under observation, precludes one from declaring the climate as the causal factor, as the three years were varied in their characteristics. By elimination, the stimulus responsible for this phenomenon may either be the presence of any virus or purely physiological. Cross inoculations were tried on a small scale, but they failed to produce any results. Further studies into the causes of this transformation are in progress.

It may be mentioned here, that the abnormal plants bore a larger number of root nodules. It is very likely that this feature is the sequel of protracted vegetative phase exhibited by these plants. The presence of an excess of carbohydrates might have stimulated the bacteria to become more active and to produce more nodules.

Worsdell, after an elaborate presentation of teratological data, concludes that the process of Differentiation of floral members is a reversionary phenomenon while their Simplification is an evolutionary event. If the teratological features portrayed above are analysed, the dissociation of the calyx and androeceum will be grouped under dialysis. The production of gynophores and the development of shoot at the carpellary axil are only examples of median and axillary proliferations. The phyllody of the calyx, corolla, pistil, funicle and ovule, and petalody of the stamens are different types of metamorphosis. As these are only different phases of Differentiation, they are to be interpreted that they are reversionary in character, and that they go to prove the foliar origin of the several floral members.

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A NOTE ON THE OCCURRENCE OF SMALL OUTGROWTHS ON THE CALYX RING OF THE COTTON FLOWER

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The author of this note has observed for the past four seasons (1929—'33) some peculiar out-growths or organs on the calyx ring of flowers produced in one of the pure lines of cotton, No. 54, a 'Northerns' Selection (*Gossypium indicum*) grown on the Agricultural Research Station, Nandyal. A fair percentage of flowers produced by this culture were found to have these organs, three in number and about two or three millimeters long when fully developed. Sometimes, only two, also one, either fully developed or in a rudimentary stage have been noticed in the flower. These structures spring from the outer base of the calyx ring and are situated one opposite each of the three bracts. Their shape is either conical, ovate or obovate and often they are cup-shaped, the hollow orienting towards the bract and away from the calyx. Rarely, the organ occupies the entire height of the calyx ring and looks as though the proximal ends of two of the sepals of the calyx have reflexed outwards and given rise to each out-growth. The tissue of this supernumerary structure resembles that of the gamosepalous calyx ring—yellowish-green in colour and dotted with black glands so characteristic of the cotton plant—in contradistinction to the dark reddish-green involucre, also full of black glands in the tissue.

Robbins in his text-book (1) mentions the occurrence of intracalcicary organs in upland cottons i.e., organs arising between the Calyx and Corolla and also observes that Cooke and Meade regard them as "Supernumerary calyx lobes or as representing free stipular elements of the calyx lobes."

Morphology of these structures apart, their presence serves as an ancillary distinguishing character for the culture.

In the F_1 of courses involving this strain, this character has been observed to be partially dominant.

Reference.

1. Robbins. Botany of crop plants.

A SUGARY EXUDATION FROM SORGHUM

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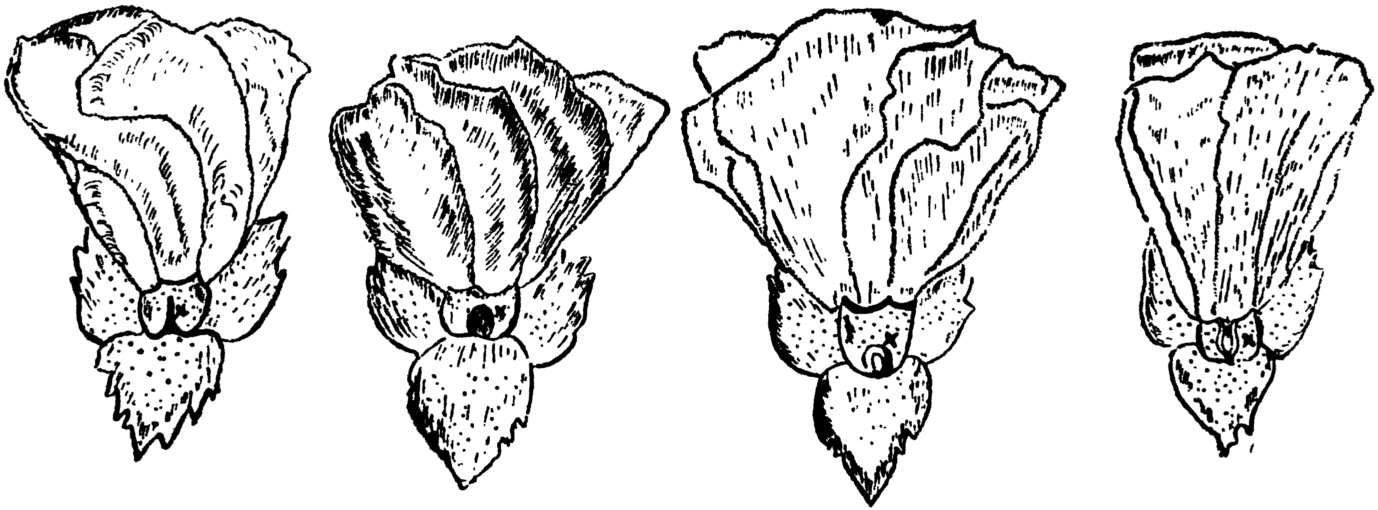
In a variety of sweet sorghum called *Tella Jonna* commonly grown in the Bellary district a sweet fluid is found to exude from the earhead of certain plants from the beginning of the flowering season. It

OUTGROWTHS OF DIFFERENT SHAPES ON THE CALYX RING



SHOWN BY THE SIDE OF × MARK

frequently collects and dries on the leaves and is the cause of attraction for the large number of ants and other insects that visit the plants. Usually it is found as a sticky semi-solid; in several cases however, crystals are formed. When this secretion takes place the ear-head remains small and undeveloped though in all other respects the plant may look normal.

T_1 is a strain which yields this secretion in abundance; T_{12} also gives some quantity of it. The sorghums grown in Coimbatore such as *Periamanjal* do not exhibit this phenomenon so markedly. The juicy nature of the variety and the setting in of the cold weather during the flowering stage seem to be the conditions favouring the production of the exudation. In Bellary district flowering takes place in the coldest part of the year and *Tella Jonna* is sweet and juicy. In Coimbatore this condition is not seen in the summer cholam and even during the main season it is occasionally observed only in certain late varieties and in some of the late side shoots. It is noticed that with the *Tella Jonna*, manuring with cattle manure, green manure or mineral manure which gives rise to a good vegetative growth also renders the plants more susceptible to this condition. Further, insects are found to be most prominent in the plants producing this exudation.

Samples of the secretion in a solid form were collected from *Tella Jonna* (T_1) in the Hagari Agricultural Research Station during two seasons - on 30—12—'31 and 24—1—'32 in the season 1931-'32 and on 20-1'-33 during the season 1932-'33. They were obtained by gentle scraping with a spatula or knife so that very little of the plant tissues was included. It was noticed that the January samples were much more crystalline than those taken in December. They were brought in stoppered bottles to Coimbatore laboratories, dried for a week in a desiccator over concentrated sulphuric acid and analysed. At this stage they were a little sticky and hygroscopic and had the smell and taste of jaggery.

By the iodine test aqueous solutions of the samples were found to contain no detectable amounts of starch or dextrin. The following table summarises the results of analyses of the samples.

Date of sampling.	Acid content as C. C. of N. NaOH for 100 g of sample.	Ash %	Total Sugar %	Reducing Sugar %	Sucrose %
30—12—31	7·75	1·36	80·4	23·5	56·9
24—1—32	8·20	1·53	79·0	14·3	64·7
20—1—33	8·60	1·49	80·6	17·8	62·8

The reducing sugars consisted of glucose and fructose only and pure sucrose could be isolated from the samples by repeated treatment with 82% alcohol containing acetic acid and subsequently washing with rectified spirits. When examined under the microscope a fresh sample of the exudation was found to contain yeast along with plenty of bacteria. A 5% aqueous solution when fresh had a pH of 5 5, after 24 hours 3 5, and after 48 hours 3·2. The total acid content increased 15 times when the solution was allowed to stand for 48 hours. The bulk of the organisms increased rapidly ; very little alcohol could be found, the fermentation leading mainly to the production of acid. No fungus spores could be detected and this was kindly verified by the Government Mycologist at Coimbatore.

It should be noted that the percentage of the reducing sugars is high, that it decreases with the advance of the season, and that, there is a corresponding increase in the sucrose content. The results are similar to those obtained for the juice of the sugary sorghums by Annett (Bull. No. 41 of the Imperial Agricultural Research Institute, Pusa). It may, therefore, be concluded that the exudation is simply the flowing out of the sorghum sap. What should have gone to fill up the grains and be transferred into starch is poured out as a sugary fluid. But the exact cause of it is not yet clear.

Help from the Farm Manager, Hagari Agricultural Research Station, in the collection of the samples of the sugary exudation is gratefully acknowledged. This work was done when the author was working in the Agricultural Research Institute, Coimbatore.

Correspondence.

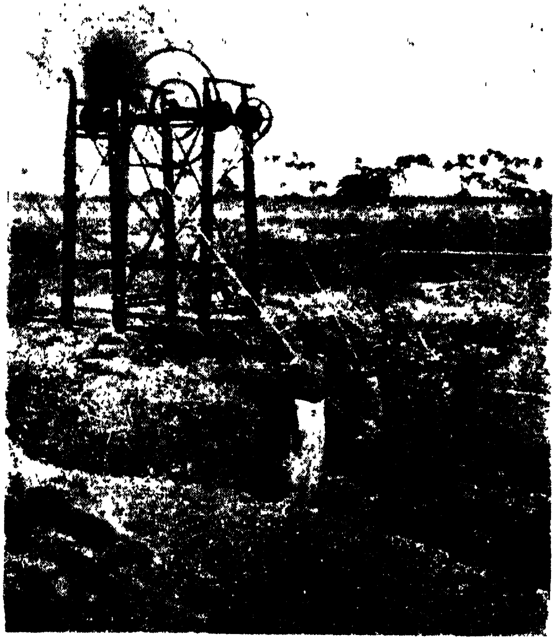
I. A locally made and improved type of Wind-mill

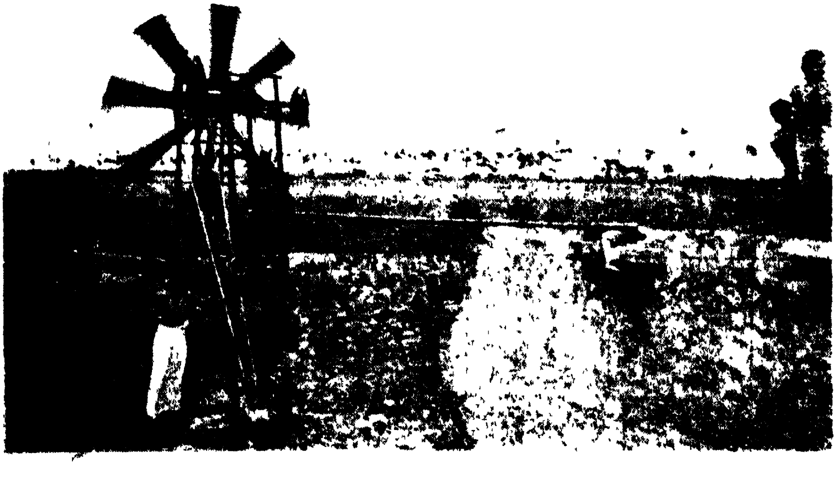
Mr S V. Doraiswamy B A, B. Sc Ag writes from Udumalpet —

In Mr. Subba Rao's garden about 3 miles from Udumalpet on the Thalli road, an ingenious kind of windmill has been erected and is giving very satisfactory results. Mr Subba Rao's son Mr. Krishna Rao, M. A, B L, under whose supervision the garden is being cultivated, has been responsible for its erection. It is interesting to note that Mr. Krishna Rao has taken up for cultivation under his supervision about 25 acres of garden which includes about 6 acres on lease. This is probably the first instance when a highly educated gentleman has taken up the position of a tenant and cultivates land on lease in addition to his own The gardens are mainly devoted to sugarcane growing and there is an oil-engine and pump fitted to one of the wells. Being a Physical Science graduate Mr. Krishna Rao has utilised his knowledge to erect a cheap, simple and efficient type of windmill, the total cost of which is about Rs 250.

The mill consists of a fan made locally of iron plates and attached to the central shaft of a condemned motor lorry differential, and coupled to a wooden fly-wheel attached to the back axis of the chassis, the wheels having been removed. A brake arrangement has also been made using the brake drum. The fly-wheel is attached to a rotary pump of two-inch delivery by means of belting. The cost of the pump and connected pipes comes to Rs. 150. The cost of the other parts does not exceed Rs. 100, including the cost of the lorry chassis. The six supporting posts are the frames of the chassis. All the parts work on ball bearings. The following are the dimensions of the windmill, discharge etc

TWO VIEWS OF THE WIND MILL IN ACTION





Height of Fan axis from ground—12 feet.
(it is proposed to raise this height to 20 feet soon)
Diameter of Fan—10 feet. Discharge—over 1500 gallons per hour.
Irrigates about 30 to 50 cents a day.

Note. Mr. Krishna Rao is contemplating to effect some improvements which will increase the efficiency and power of the mill. There is strong westerly breeze for six months from about May and easterly winds for two months from October.

II. Wild Life in Southern India.

(We have received the following from the Collector of Coimbatore, for publication in our Journal—*Ed M. A. J.*)

Amongst the many and great changes which have been taking place in India during recent years there is one which is not commonly known and which, if it were realized, would excite the sympathy of all right-minded people. The change referred to is that which has taken place with regard to the destruction of wild animals, chiefly in order that their meat may be sold to enrich people who have no consideration for the lives of any living craatures in the wild state. No doubt Providence provided many of the wild animals for the use of Man and until recently in India, Man used this gift wisely. Nowadays, however, the march of civilization which has brought the motor car, electric torches and cheap fire arms has made the destruction of Wild Life so much more easy than it used to be that unless Public opinion is stirred up to put a stop to the ruthless destruction that is going on, a time will arrive at no distant date when many species will cease to exist. What is happening in Southern India is also happening in other parts of the world. In several countries the Public have become alive to what is going on and have decided that unscrupulous people must not be allowed to make money by going about at night with electric lights or in cars, shooting any wild animals that they may see, including females and young ones. In these countries Societies have been formed in order to take steps to put a stop to the indiscriminate destruction of Wild Life and to help the Government in enforcing the existing laws. There is no doubt that Southern India should not be backward in following so admirable an examples and it is understood that His Excellency the Governor of Madras intends shortly to invite all those interested in preventing the wholesale slaughter of our wild animals to attend a public meeting in Madras, over which he will preside, with the object of forming a Society for the Preservation of Wild Life in Southern India. It is sincerely to be hoped that all those who read this will make a point of discussing this new and very interesting subject with their friends and that as many as possible will attend the meeting and join the Society.

An appeal to Landowners. In almost all countries of the world there has in recent years been an awakening of public interest as to the urgent need of adequately protecting Wild Life in all its aspects.

India has up to the present time been backward in this matter, for outside the Government forests birds and beasts of the field have been looked upon as fair game to all those who have been able to shoot or snare for sport or for profit. Neither sex nor age has been spared, and breeding seasons have been entirely disregarded.

Within Government forests shooting has for the past fifty years or so been restricted by licence; but there are many who carry on the slaughter in these areas also, for it is not easy to detect offenders.

Now is the time. The time has now come when, if the present generation does not speedily realize—or realizing ignores—the fact that the heritage of Wild Life received from previous generations is being woefully squandered, many species of birds and animals will become extinct. Once the number of any species has been reduced to a certain low ebb the end is at hand; for Nature has been interfered with, and a greatly diminished species cannot survive against the many natural enemies—The tigers and the cats, the eagles and the hawks devour them; the mongooses, the lizards and the snakes prey upon the eggs and the young.

The Landowner is responsible Who are the men of the countryside of fifty years of age who can say that Wild Life in their own neighbourhood has not greatly diminished since the days of their youth? And whose is the blame?

All the world over the Wild Life on the land is the property of the owner of the land, and his is the responsibility He cannot say that it is his to do what he likes with, for he is responsible to The Creator of all things to preserve that which has been created. He must not allow Wild Life to be persecuted to extinction.

A man will not suffer his flocks and his herds, his fowls and his pigeons to be raided and destroyed. There is greater reason to safeguard and protect the wild animals and birds, for his cattle and sheep he can replace, but Wild Life once gone can never be replaced.

So let us hope that this appeal to Landowners great and small will cause them to take thought to the future, realize the danger that is here plainly before their eyes beyond any question or dispute, and bestir themselves to take action before it is too late to preserve the Wild Life for which they are responsible.

A Society for the Preservation of Wild Life. In the United Provinces of India a Society has been formed for the Preservation of Wild Life, and it is understood that his Excellency the Governor of Madras intends shortly to invite all those interested to attend a Public Meeting in Madras, over which he will preside, with the object of forming a Society for the Preservation of Wild Life in Southern India.

All owners of Land are interested What owner of land is there who, having read the above, can say he is not interested? All ought to endeavour to attend, or be represented, and all should now take action; for every day of delay means the lives of animals and birds which should be preserved.

Notes & Comments

1. **University Degree for Veterinary Science.** As already referred to in our last issue, the subject of affiliating the Madras Veterinary College to the local University, and bringing up the standard of studies in that Institution for a University degree in Veterinary Science came before the Academic Council and the motion was accepted for instituting a degree B. Sc. (Veterinary) and recognising the Veterinary College, Madras as an Institution for preparing students to that degree. There has been a demand for a better class of Veterinary Surgeons and this question arose on the initiative of the Director of Veterinary Science. We congratulate our sister College on this recognition.

2. **Another Agricultural Colony Scheme.** We understand that two wealthy planters and miners of Vellore, Messrs Vas and Sinha, are about to inaugurate a scheme of agricultural colonisation in the Kulitalai Taluk of Trichinopoly where it appears they own an area of 2000 acres of cultivable land. Their idea seems to be to divide the area into small farms of 20 acres each. A superintendent for each would

be employed, and he would be from among the unemployed middle class South Indians, such recruitment being based on non-communal considerations but on suitability in each case. The projected colony, it is the hope of the proprietors, would be a small democratic unit of 100 superintendents with their families, living and moving freely without any distinction of caste, faith or nationality.

Besides agricultural activities in the colony, it is proposed to provide a school of cottage industries, a bank, a provision store, and a national emporium stocking all Indian-made goods, for the benefit of the colonists. A spinning and weaving establishment will also be a chief feature.

Profits earned in the colony will be distributed among those who reside in the colony only and only a small portion of it will be appropriated towards the administration charges and against the Rural Development Fund the management have created. An extensive practical programme for the development of the villagers is proposed to be carried out with the aid of the colonisers themselves. The venture appears to be a very ideal one and we offer our best wishes to the two gentlemen on their very laudable attempt.

3. **Fish Culture in South India.** We are glad to note that the Imperial Council of Agricultural Research have approved of a scheme formulated by the Agricultural Department of the Madras Government for development of rural pisciculture. In this presidency all irrigation wells, ponds and tanks have water only for part of the year, roughly for three to nine months; and in the course of their investigation, the Agricultural Department have urged the necessity for steps being taken to determine the kind of fish that could be grown in water sources which had supply only for limited periods in the year. They feel that the methods of cultivating fish in perennial sources do not apply to such ponds, wells and tanks. Just as different crops were grown on land, according as there was supply of water, it is possible, in their view, to rear varieties of fish crops, annual, wet and dry as the case may be.

The development of the art of pisciculture had not been seriously tackled in this country in the past due to the religious sentiment against growing living things in order to eat them. Such sentiment is now gradually disappearing as medical opinion is conclusive that rice is notoriously deficient in nutrition, if taken by itself. Further the Dietetic Commission in Japan has held that fish is the best corrective to rice.

The Madras Government have agreed to provide fish ponds, laboratories and lands and the Advisory Board of Imperial Council of Agricultural Research has recommended the sanction of Rs. 60,000 for experiment being conducted for a period of five years.

4. **Wild Life Protection in North India.** We invite the attention of our readers to a comment published elsewhere on this subject. Though late in the field it is commendable that people have begun to feel the need for the protection of wild life. The lion which was roaming wild in Sind and Cutch over two hundred years ago has been made extinct and it is only a question of time when the ibex, bison and other wild forms of life will share such a fate if something is not done in this direction. In the United States of America there are what are called National Parks in different parts of the States and in these places special attention is paid to the proper preservation and perpetuation of some of the remarkable creations of nature which are mercilessly driven to extinction by man's rapacity in various parts of the world.

ABSTRACTS.

Studies on Paddy Cultivation—II. The effect of manures on the composition of the Paddy crop and Soil. A. W. R. Joachim, S. Kendiah and D. G. Pandithesekere (The Tropical Agriculturist, Ceylon, 1933, Vol. 81, pp 11—35) In order to determine the optimum conditions of manurial and cultural treatment, which would secure most favourable results with paddy grown under the irrigated system of paddy cultivations under the soil and climatic conditions of Ceylon, a series of three experiments was started by the Ceylon Department of Agriculture. The first of these experiments carried out during the *Maha* 1931—32 and *Yala* 1932 seasons (October 1931 to September 1932) aimed at a statistical analysis of the intake of nutrients at different stages of growth, as influenced by different kinds of manuring. The second experiment being conducted during the *Maha* 1932-33 and *Yala* 1933 seasons will test the efficiency of different systems of cultivation as transplanting, broadcasting etc; with and without manuring; cost figures will also be kept in order to determine the most economic system to adopt. The third experiment to be carried out during the *Maha* 1933-34 and *Yala* 1934 seasons will investigate the question of the optimum time of application of fertilisers and also whether smaller doses of manure, one of which is to be applied just before flowering, would give better results than the application of one large dose at sowing. The most suitable phosphatic manure to be used for paddy will also be investigated.

The present paper reports the results of the first series of experiments where randomised plots 1/100 acre each, (triplicated 6 times) were treated with green manure (Tithoria diversifolia) at the rate of one ton per acre, superphosphate at the rate of one cwt, per acre, a broad ratio of ammonium phosphate at about 100 lbs. per acre, and a mixture of green manure and superphosphate at the above rates. A statistical analysis of the data obtained showed that—(1) The average percentage constituents of the *Maha* crop (duration 6½ months) are generally higher than those of the *Yala* crop (duration 4½ months) The *Maha* crop, at the stage of harvesting contained, for whole plants, 55·4 per cent. dry matter, 0·85 per cent. nitrogen, 12·0 per cent. ash, 0·30 per cent. phosphoric acid, 0·80 per cent. potash, 0·39% lime, and 9·00% silica. The *Yala* crop, on the other hand contained for whole plants at the stage of harvesting, 47·5 per cent. dry matter, 0·71 per cent. nitrogen, 15·0 per cent. ash, 0·22 per cent. phosphoric acid, 1·18 per cent. potash and 0·40 per cent. lime. The figures for phosphoric acid are much lower than those reported in Hawaii and other places, indicating the deficiency of Ceylon soils in phosphoric acid. The composition of the crop does not show much variation with treatment; the crop from the ammonium phosphate plots showed however, markedly higher phosphoric acid content during the *Maha* season. (2) At the stage of flowering, only about 50 per cent. of the nitrogen and dry matter, ash and phosphoric acid and 78 per cent. of the potash and lime of the crop at harvest were absorbed during the *Maha* season. The corresponding *Yala* figures are much lower, only about 34 per cent. of the nitrogen, 26 per cent. of the phosphoric acid, dry matter and ash, and 35 per cent. of the lime and potash having been assimilated at the flowering stage. (3) Considering both *Maha* and *Yala* data, the grain at harvest contained 71 per cent. of the nitrogen, 82 per cent. of the phosphoric acid, but only 21 per cent. of the lime and 12 per cent. of the potash of the whole crop. The straw on the other hand contained 86 per cent. of the potash, 78 per cent. of the lime, and only 15 per cent. of the nitrogen and phosphoric acid. (4) Worked on an average basis, the total constituents removed by the paddy crops cultivated during a period of one year (*Maha* crop about 2000 lbs, and *Yala* crop 1000 lbs grain per acre : straw about equal weight) are:—nitrogen 46·5 lb.; phosphoric acid 15·6 lb.; potash 59·9 lb.; and lime 25·3 lb. (5) Soluble phosphoric acid applied in fertilisers is absorbed only to the extent of 20 to 25 per cent. of the quantity applied. The addition of phosphatic fertilisers caused no appreciable increase in the water—soluble phosphoric acid content of the soil. The possibility of "solid phase" feeding of phosphoric acid by the paddy plant is indicated In view of this possibility and of the conversion of soluble phosphates into insoluble compounds, the use of bonemeal for manuring paddy is suggested. (6) About 2/3 of the nitrogen with green manure and nearly all in ammonium phosphate was assimilated, as shown in the increased yield. From 75 to 85 per cent. of these constituents were absorbed during the *Maha* season. (7) Analysis of the soil showed heavy losses of fertilising constituents much above those absorbed by the growing crops. The losses were especially marked at the end of the *Maha*, and were arrested during the *Yala*, probably due to addition of crop residues. Decrease in organic matter of soil represented a loss of 2 tons carbon and 360 lbs. nitrogen (crop produced about 3 tons with about 50 lbs. nitrogen and 1·5 tons carbon). The carbon-nitrogen ratio of the soils remained in the neighbourhood of 11. (8) Exchangeable base determinations showed loss of all bases. The losses are greatest with exchangeable calcium which are present to the extent of about 72 per cent. of the total exchangeable bases (from 5·16 milli-equivalents to 4·45 m. eq. per 100 gm. soil), and are considerably higher than the amount absorbed by the crop. Exchangeable potassium was less by an amount equal to that absorbed by the crop. The exchangeable ammonia content decreased with the growth of the crop. (9) The pH value of the soils increased slightly on pH puddling (from pH 5·59 to pH 5·77), but diminished again with growth of the crop (to pH 5·40). (10) The phosphoric acid absorption data would appear to indicate that two or more small doses of soluble fertilisers might give better results than a single large application. (C. N.)

The vitamin B content of different samples of Indian rice by Spruyt's colorimetric method Part II :— H. W. Action, S. Ghosh and A. Dutt (Indian Jour. Med. Research 1933, Vol. 21, pp 103—107). In a previous paper (Ibid, 1933, Vol. 20, No. 3), the authors had reported the vitamin B assay of samples of rice obtained from rice mills or dealers round about Calcutta. The present paper reports assays of samples of paddy with white (silver skin) and red pericarp, secured from the Government Agricultural Department, Bengal and milled under standard conditions. The treatments compared were, hand hulling (*dhenki* rice, prepared by boiling the samples in earthern pots and hulling by hand in a *dhenki*), parboiling, milling, polishing, and preparation of "*atap*" rice (sun drying and milling). The Vitamin B content was determined by Spruyt's colorimetric method and feeding experiments were also carried out with *munia* birds (*Munia maja* and *Munia* Cucogastroides) available in the local market. Some of the interesting points brought out by the comparative study were:—(1) parboiling conserves the vitamin B. content and protects it from appreciable loss even on subsequent milling. But *polishing* of such parboiled, milled rice, (with French chalk for several hours) and *washing* in running water (for 48 hours) were highly detrimental to the vitamin content. Thus parboiled white rice once hulled (milled) showed a colour index of 197·14, while twice hulling reduced it to 164·65, polishing to 121·55 and washing to 34·0. (2) *Dhenki* rice (hand hulled) was superior to machine-milled rice and parboiled rice superior to "*Atap*" (sun dried, milled rice) sundrying, obviously has a harmful effect on vitamin B. content and this was confirmed by feeding trials, wherein *Munia* birds fed on parboiled-machine-milled rice, continued to live on the 30th day, while those fed on milled "*atap*" (sun-dried) rice mostly died. (3) There was not much appreciable difference in vitamin B. content between the rice samples with white and red pericarps which were examined in the present study. (C. N.).

Pests of Garden Plants I. *The root eating ant. Dorylus orientalis. Westw* (Tropical Agriculturist, vol. 80, p, 276). The workers live underground, and hence their presence is not detected until the plants begin to wilt. As it is difficult to exterminate them without injuring the plants, when once the colony gets established, a method of applying petrol is suggested both as a remedy and as a preventive. One to two pints are sufficient for thirty square feet and can be applied in shallow furrows and covered. Two days before planting, the area can be treated with saw dust or woodashes steeped in carbolic disinfectant, at the rate of two tablespoonfuls for every bottle of water. If the attack is detected after the planting, petrol can be poured round the plant at distances of six to nine inches, and covering with wet earth. The dead plants must be pulled out. (R. B.)

The Branching of Egyptian Cotton Plants, (Ministry of Agri. Egypt. Tech. and Sci. service. Bot. section Bull. 87). The author working with Egyptian variety finds that an accessory bud if it develops, gives rise to only a sympodium, while an axillary bud may produce a monopodium or a single flower, depending upon the time of development of the corresponding accessory bud. The main stem of an Egyptian cotton may be divided into four well defined zones and the number of internodes composing such zones varies with variety. Cutting off monopodia or apical bud (topping), forces the development of axillary and accessory buds. The significance of the branching habit may be seen from the relation between the yield and the position of first sympodium. A monopodial type is late and suffers from pink boll-worm attack. An ideal type for Egypt is one having monopodia at the axils of the cotyledons, or the next higher node. The flowering curve of such a type would rise more rapidly and reach a higher maximum than the present varieties and the flowering period being shorter, would suffer less from bollworm. (R. B.).

The Natural crossing of cotton flowers in Egypt. (Ministry of Agri. Egypt. Tech. and Sci. Bulletin No. 89). Under Egyptian conditions the authors find that there are seasonal variations in the percentage of vicinism, due mostly to the habits of pollen-carrying insects. The maximum vicinism occurs during the first picking and falls to a half later. The use of the late-picked seeds lowers the percentage of rogues. The percentage contamination varies with the nature of the source viz. line front or a point source. The incidence per ovule at the time of maximum vicinism is found to be one per thousand at a distance of one hundred metres. The product of vicinism and the square of the distance is a constant for a single rogue up to a distance limit. Long distance jumps from one field to another are yet puzzling. The need for belting is apparent. The economical use of pure material raised from plants grown under cages, and the sowing of successive generations in a concentric lay out, the crop of one year being protected by a belt of the crop from the seed of the previous year, are imperative for the maintenance of a pure crop. Unless such elaborate care is taken, a variety may easily run out. (R. B.)

Perennial cultivation of cotton with special reference to the cultivation of ratoons in Egypt (Ministry Agri. Egypt Tech. Sc. Series, Bulletin No. 75). Experiments conducted to compare the ratoon and first year cotton plants on their relative merits of flowering, yield, quality and insect damage are described. The ratoons are earlier and steeper in flowering. The crop arrives on the market a week early and commands a better price for its quality. The effective flowering period being shorter, the ratoons escape the bollworm damages. The yields are variable and mostly depend upon the varieties ratooned. Certain seasonal disadvantages point towards the successful raising of ratoon cotton, in waterlogged places in preference to first year plants. The quality of first and second picking is definitely better than that of the first year crop. The ratoons suffer less from the insect pests and do not carry the insect pests over winter in Egypt. Resting larvae of pink bollworm are fewer in ratoon except for the third picking, which is usually very small in quantity. For the above reasons it would be profitable from an entomological view point, to raise ratoon and first year plants throughout the country in alternate years. This would give a shorter and a longer close period in alternate years between two cotton crops. (R. B.)

Gleanings.

Limit of Sugarcane Yield. Dr. Prinsen Geerligs has recently stated that during the last 10 years, the production of sugar per acre has increased in Java by 30 per cent., and in Hawaii by 50 per cent. Similar increases have been obtained in certain other sugar-producing countries, such as Formosa and the Phillipines. It is possible to calculate the theoretical limit to increased production, assuming that the nitrogen content of sugarcane is 0·084 per cent of the weight of the whole plant (as it is in P O. J. 2878 and H. 109). Results of this calculation (which is based on the Mitscherlich law of growth) indicate that the maximum possible yield of such sugar-cane varieties is about 160 tons per acre, or about 25 tons of sugar per acre. These yields may be obtained only when the supplies of water and of plant nutrients are adequate, and when other environmental growth conditions are fully satisfactory. Several plantations in Hawaii have already recorded yields approximating to the theoretical limit, so that suitable modifications of the environment may yet lead to increased yields in other regions. The theoretical 160 ton maximum, is based on the assumption that the nitrogen content of the cane is 0·084 per cent. Since yielding ability is inversely proportional to nitrogen content, it would appear possible to exceed the 160 ton per acre limit, by breeding new sugarcane seedlings containing less than 0·084 per cent. nitrogen; the practical limit evidently has not yet therefore been obtained. (*Tropical Agriculture, Trinidad, August 1933*).

Soybean flour. A new type of flour, made from soybeans, is said to combine whiteness with a complete absence of the characteristic disagreeable soybean odour and flour. The patented process of manufacture removes all but 1·7 per cent of the oil from the soybean. The protein content is 68 per cent. The flour called " Nusoy " is finely ground and may be used in white bread and other baked goods, in sausage, bologna, wieners, macaroni, and other products where water absorption and retention are important. When used in bread, 2 to 3 per cent. increases the protein content of the bread appreciably. And the bread has a good appearance, is tasty and remains fresh unusually long. For diabetic bread, the baker uses Nusoy to the extent of 9 per cent. with gluten flour to give an almost starch-free loaf containing double the protein content of ordinary white bread. The high absorption ability of the flour effects a 10 per cent. increase in the number of loaves, it is asserted. (*A. E. B. in Scientific American. July 1933.*)

Crop & Trade Reports.

Cotton Crop, Madras, 1933—34, First Report. The average of the areas under cotton in the Madras Presidency during the five years ending 1931—'32, has represented 9·0 per cent. of the total area under cotton in India.

2. The area under cotton up to the 25th July 1933 is estimated at 176,500 acres. As compared with the area of 210,600 acres estimated for the corresponding period of last year, there has been a decrease of 16 per cent.

3. *Central Districts and South—mainly Cambodia Tract.*—The area in the Central districts and the South represents the last year's crop left on the ground for second pickings before the plants are removed in September in compliance with the provisions of the Pest Act. The area in these districts fell from 137,100 acres to 115,500 acres, i e., by about 16 per cent. The yield is expected to be below normal due to the want of sufficient showers in June,

4. *Deccan or Northerns and Westerns tract.* In Bellary, where the early crop is sown in June, the area rose from 22,500 to 28,000 acres owing to the good rains received in May. In the other districts the area has fallen owing to the inadequacy of timely rains.

5. *Cocanadas tract.* There has been a decrease in the area in Guntur and Nellore due to the insufficiency of timely rains.

6. The wholesale price of cotton lint per Imperial maund of 82 & 2/7 lb., as reported from important markets towards the close of July 1933, was about Rs. 18—10—0 for Cocanadas, Rs 16—14—0 for red northerns, Rs 18—2—0 for white northerns. Rs 16—7—0 for (early crop) westerns, Rs 25—4—0 for Cambodia, Rs. 23—2—0 for Coimbatore karunganni, Rs. 24—11—0 for Tinnevelly karunganni and Rs. 20—13—0 for nadam. *(From the Board of Revenue, Madras).*

Groundnut Crop, Madras, 1933—34, Second Report. *Summer crop—Area and yield.* The area under the summer or irrigated crop of groundnut in parts of the Madras Presidency during the five months of January to May 1933 is estimated at 74,800 acres. Compared with the area of 67,700 acres estimated for the corresponding period of last year, there has been an increase of 10 per cent. The crop has been harvested in most places. The yield is reported to be below normal in Nellore, Chittoor, North Arcot and Trichinopoly. The total yield is estimated at 65,500 tons of unshelled nuts as against 60,400 tons during the corresponding periodof last year.

2. *Early crop—Area and yield.* The area under the early crop of groundnut (mostly unirrigated) up to the 25th July 1933 in the districts of Salem and Coimbatore is estimated at 168,000 acres. Compared with the area of 159,000 acres estimated for the corresponding period of last year, there has been an increase of 6 per cent. The want of timely rains has delayed the sowings for over a month in the district of Salem. The condition of the crop is good. The total yield is estimated at 84,000 tons of unshelled nuts as against 79,500 tons estimated for the corresponding period of last year.

3. *Price.* The wholesale price of groundnut, shelled, per Imperial maund of 82 & 2/7 lb. towards the close of July was Rs. 4—14—0 in South Arcot and Rs. 3—11—0 to 3—14—0 in the other districts. *(From the Board of Revenue, Madras).*

Sugarcane Crop, Madras 1933, First Report. The average of the areas under sugarcane in the Madras Presidency during the five years ending 1931—33 has represented 3·6 per cent of the total area under sugarcane in India.

2. *Area.* The area under sugarcane up to the 25th July 1933 is estimated at 103,740 acres. The area estimated for the corresponding period of last year was

103,930 acres. There has been a large decrease in the districts of Anantapur, South Arcot, North Arcot and Trichinopoly, which has been partly made good by an appreciable increase in the Circars and Bellary.

3. *Condition.* The condition of the crop has been satisfactory except in the Districts of Chittoor, South Arcot, and North Arcot where it has been partly affected by want of sufficient rains.

4. *Price.* The wholesale price of jaggery per imperial maund of 82 & 2/7 lb. towards the close of July was Rs. 3—8—0 in Vizagapatam, Rs. 6—0—0 in Erode (Coimbatore) Rs. 3—5—0 in Vellore (North Arcot) and Rs. 4 to 4—8—0 in the other important districts. (*From the Board of Revenues, Madras*).

All India Final General Memorandum on the Wheat Crop of 1932—'33. The total area reported is 32,992,000 acres, as against 33,803,000 last year, or a decrease of 2 per cent. The total yield of the crop, which has already been harvested is estimated at 9,452,000 tons (44,109,000 quarters of 480 lbs. each) as compared with 9,024,000 tons (42,112,000 quarters) last year or an increase of 5 per cent.

Provinces and States.	Area (1000 acres).		Yield (1000 tons).		Yield per acre in lbs	
	1932—33	1931—32	1932—33	1931—32	1932—33	1931—32
Punjab.	9,927	10,392	3,255	3,152	734	679
United Provinces.	7,789	7,864	2,744	2,633	789	750
Central Provinces & Berar.	3,553	3,628	670	693	422	428
Bombay.	3,161	2,835	782	592	554	468
Central India.	2,068	2,189	340	339	368	347
Hyderabad.	1,301	1,367	168	161	289	264
Rajputana.	1,268	1,508	355	364	627	541
Bihar & Orissa.	1,235	1,221	492	469	892	860
N. W. F. Province.	1,012	1,014	237	250	525	552
Gwalior.	1,394	1,492	319	297	513	446
Baroda.	74	72	31	21	938	653
Delhi.	42	41	11	9	587	492
Ajmer—Merwara.	22	31	6	9	611	650
Bengal.	143	145	41	34	642	525
Mysore.	3	3	1	1	463	361
Total ...	32,992	33,803	9,452	9,024	642	598

It will be seen that the present estimates of yield as compared with the final figures of last year show an increase in all the important wheat—growing areas except in the Central Provinces and Bihar, Northwest Frontier Province and Rajputana. The yield per acre in the present season is 642 lbs, as compared with 598 lbs. last season. In addition to the areas for which particulars are given above, the crop is grown in certain other tracts (Burma, Madras, Kashmir and Benares State) from which no reports are received, and the average area under wheat in these tracts for the last five years has been estimated at 563,000 acres with a yield of 161,000 tons. (*The Indian Trade Journal, August 10. 1933*).

First Cotton Forecast, All India, 1933—34. This forecast is based on reports on the condition of the Cotton crop at the end of July or early August, and relates to about 77·5 per cent. of the total area under the crop The area sown is at present estimated at 14,031,000 acres as compared with 13,413,000 acres (revised) at the corresponding time of last year, or an increase of 5 per cent. Weather conditions at sowing time were not quite favourable, and the present condition of the crop, is on the whole, reported to be fairly good. (*Indian Trade Journal August 24, 1933*)

First Sugar-cane Forecast, All India, 1933—34. This forecast is based on reports received from areas containing about 95 per cent. of the total area under sugarcane in India. The total area planted with sugarcane this year is estimated at 3 349,000 acres, as against 2,982,000 acres at this time last year, or an increase of 12 per cent, the increase being mainly in the United Provinces (139,000 acres) Bihar and Orissa (158,000 acres) and the Punjab (35,000 acres). Bengal shows an increase of 21,000 acres, while the area in Madras remains stationary at 104,000 acres. Weather conditions at the time of planting were favourable, and the present condition and prospects of the crop, on the whole, are reported to be generally good. (*Indian Trade Journal, August 21,1933)*

First Groundnut Forecast, All India, 1933—34. This forecast is based on reports received from the three Provinces of Madras, Bombay and Burma and the State of Mysore, which together contain over 86 per cent. of the total area under groundnut in India. The total area, so far reported, is estimated at 2,080.000 acres as against 1,681,000 acres reported at the corresponding time of last year. Excluding the area for Mysore which is not available for the last year the present estimate of area shows an increase of 15 per cent. Weather conditions at sowing time were not quite favourable, but the present condition and prospects of the crop, on the whole are reported to be fairly good. *(Indian Trade Journal August 24, 1933).*

Weather Review (AUGUST—1933)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st	Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	9 6	+2·3	26·8	South	Negapatam	2·9	−0·6	12·8
	Berhampore *	9 3	+0·1	34·3		Aduthurai *	2·0	−1·3	10·9
	Calingapatam	4·0	−2 9	26.2		Madura	10·5	+6·2	21·4
	Vizagapatam	2·4	−2·7	11·8		Pamban	1·7	−0·1	5·9
	Anakapalli *	4·7	+1·1	24·3		Pilamkottah	0·4	−0·1	14·0
	Samalkota *	3·8	+0·4	16·3		Koilpatti *	2·7	+0·8	9·2
	Cocanada	3 5	−2 1	15 1					
	Maruteru *	...	...	...					
	Masulipatam	5·8	−0 4	2 ·7	West Coast	Trivandrum	7·2	+3·1	88·5
						Cochin	20·0	+7·7	123·1
						Pattambi *	...	...	...
Ceded Dists.	Kurnool	4·9	−0·2	14 0		Calicut	16·3	+1·0	133·1
	Nandyal *	9·3	+5·4	22·1		Taliparamba *	22·7	−6·1	150·2
	Bellary	11 0	+8·9	21·6		Kasargode *	17·1	−7·9	138·7
	Hagari *	10·5	+9·5	15·9		Nileshwar *	17·6	−8·5	118·8
	Anantapur	12·2	+9·5	21·0		Mangalore	14·2	−9 0	130·3
	Cuddapah	6·3	+0·6	14·5					
Carnatic	Nellore	3 5	+0·4	7·0	Mysore and Coorg	Chitaldrug	7·8	+5·0	19·5
	Madras	3 0	−1·5	7 8		Bangalore	10·2	+4·9	26·7
	Palakuppam *	3·6	−1·0	16·0		Mysore	8·9	+5·6	27·5
	Palur *	4·4	+1·3	25·2		Mercara	28·3	+2·6	123·7
	Cuddalore	3·1	−2·3	20·5					
Central	Vellore	8·6	+2·8	13 3					
	Salem	9·3	+2·8	22·2	Hills.	Kodaikanal	14·4	+5·8	42·5
	Coimbatore	2·4	+1·3	10·5		Coonoor *	8·5	+4·7	29 5
						Kallar *	8·0	+5·4	29·5
	Coimbatore Res. Inst. *	2·2	+1·2	12·2		Ootacamund *	17·1	+9·0	42·2
	Trichinopoly	7·7	+3 9	15·8		Nanjanad *	14·0	+6 7	38·9

* Stations of the Agricultural Dept.

Summary of general weather conditions: The monsoon was generally strong on the west coast and in the Circars under the influence of three depressions in the Bay till the 10th. It then weakend and wide-spread thunderstorms occurred over the south of the peninsula till the end of the month.

The Bay depression which lay off Gopalpore at the end of the last month, crossed the coast near that station on the 2nd and disappeared rapidly. A low pressure wave propagated across Burma, developed into a storm over the head of the Bay on the 2nd and crossed the coast near Chandbali on the 3rd. It then moved in a north-westerly direction and filled up over west Rajputana on the 9th. A third depression appeared off the south Arakan coast on the 7th. as a result of the transmission westwards of a low pressure wave across Burma, and developing and moving rapidly, crossed the coast near Chandbali on the 9th. morning and moving across the Central Provinces, merged into the seasonal trough of low pressure over North-west India by the 12th. These three depressions gave rise to particularly heavy rain in Orissa and in the adjoining regions. Cuttack reporting 13 inches of rain on the 4th.

Pressure distribution over the peninsula after the 10th. was of an abnormal type being more of the transitional type than that usual in August, and determined wide-spread thunderstorms over the south of the area. Thunderstorm activity was most marked almost throughout the month after the 10th., in the Deccan and Mysore and adjoining regions.

Rainfall was markedly above normal in the Deccan, Mysore and the central districts, locally in excess in Ganjam, and in defect in the Malabar coast and locally in the Circars.

The chief falls reported were: Anantapur 4·3″ (27th); Bellary 3·9″ (21st); Cochin 3·9″ (22nd); Vellore 3·5″ (11th.) and Madura 3·0″ (19th).

Weather Report for the Research Institute Observatory:

Absolute maximum in shade	91·5
Absolute minimum in shade	69·5
Mean maximum in shade	87·1
Departure from normal	- 0·4″
Mean minimum in shade	71·5
Departure from normal	...
Total Rainfall for month	2·16″
Departure from normal	+ 1·15″
Heaviest fall in 24 hrs.	0·92″
No. of rainy days	4
Mean daily wind velocity	4·6 M. P. H.
Mean humidity at 8 hrs.	80·2 %
Departure from normal	+ 6·9 %
Total hours of bright sunshine	193·9
Mean daily hours of bright sunshine	6·3

General weather conditions: The monsoon was generally active during the first ten days of the month. It then weakened and thunderstorms were very frequent especially during the last fortnight. Rainfall was markedly in excess and occurred in connection with thunderstorms.

Day and night temperatures were nearly normal during the month.

P. V. R. & T. S. L.

Departmental Notifications.

I Circle. I. Kurma Rao, A. F. M. Anakapalle, l. a. p., for one month from 3—8—'33. P. Lakshminarayana, A. A. D. Narasapur extension of l. a. p. on m. c. for 19 days from 13—8—'33. B. P. Papiah A. A. D., Yellamanchilli transferred to Tadeppallegudem Vice D. Bapaiah transferred to Guntur. B. Venkataramana transferred to I Circle. A. Rammohan Rao A. D. Rajahmundry to Peddapur subcircle. A. Kondayya Sarma A. A. D. Tanuku, to Razole. D. Hanumantha Rao A. D. Razole, to Tanuku. **III Circle.** A. Gulam Ahmad, offg. F. M. Hagari, extension of leave on m. c. on half average pay for 15 days from 3—8—'33. K. Balaji Rao A. F. M. Hagari, extension of l. a. p. on m. c. for six months in continuation of leave already granted. **IV Circle.** K. Varadachari, F. M. Palur l. a. p. for two months from 7—8—'33. M. A. Balakrishna Iyer, A. D. Walajah l. a. p. for 10 days from 4—9—'33. C. Annamalai A. D. Palmaneir posted to Trivellore, to be in charge of motor exhibition van. M. Gopalan Unnithan A. D. on return from leave posted to Gudiyattam. M. K. Swaminathan A. D. Gudiyattam as A. D. Vellore. **V Circle.** M. Subbiah Pillai, Assistant, Agricultural Research Station, Aduturai, l. a. p. for 12 days from 22—8—'33. **VI Circle.** A. Ramalinga Iyer A. D. on return from leave posted to Koilpatti. K. Ramaswami Iyer A. D. Koilpatti l. a. p. for three months from 1—9—'33. A. M. Muthiah Nattar, A. D. Dindgul l. a. p. for three weeks from 20—8—'33. S. Bhima Raju A. A. D. Tinnevelly l. a. p. for one month from 1—9—'33. A. Ramalinga Iyer, extension of l. a. p. for ten days in continuation of leave already granted. C. S. Rajaratnam Mudaliar A. A. D. extension of l. a. p. on m. c. for one month in continuation of leave already granted C. S. Namasivayam Pillai A. A. D. l. a. p. on m. c. for one month from the date of relief. K. Sivasankara Menon A. D. Dharmapuri l. a. p. for two months from the date of relief. K. Kuppamuthu A. D. under training to join duty at Dharmapuri. **Paddy Section.** S. Dharmalingam Mudaliar, Assistant, l. a. p. for 10 days from 2—9—'33. V. M. Ramunni Kidavu F. M. Pattambi l. a. p. for 25 days from 22—8—'33. **Cotton Section.** S. M. Kalyanaraman, Assistant, extension of l. a. p. for one month in continuation of leave already granted. K. L. Ramakrishna Rao, Assistant, l. a. p. for 12 days from 7—8—'33. **Chemistry Section.** K. Veerabhadra Rao, offg. Assistant, Anakapalle, extension of l. a. p. for 2 days on 1st and 2nd September, 1933. **Millets Section.** P. V. Harihararan l. a. p. on m. c. for 6 weeks from 26—8—'33. S. Madhava Rao l. a. p. for 6 days from 4—9—'33. **Entomology Section.** John A. Mulyil, Assistant, leave for two years from 22—8—'33. A. G. Ramaswamiah, sub-assistant, extension of l. a. p. for one month in continuation of leave already granted. **D. A's. Orders.** A. Chinnathambi Pillai, l. a. p. for 2 months and 19 days from the date of his reversion to the Madras Agricultural Subordinate Service. L. Krishnan whose officiating appointment terminates on the 19th. August, will continue to officiate till 16th. September '33. C. Narasimha Acharya Assistant Lecturer in Chemistry, leave on half average pay for one year, one month and fourteen days from 1—9—'33 for the purpose of higher studies in England. **Transfers.** B. Venkataraman, A. A. D. Guntur, to I circle. D. Bapaiah A. D. Tadepallegudem to II circle. A. Kondayya Sarma, A. A. D. Tanuku, l. a. p. for one month on m. c. from 1—9—33. Dr. S. Kasinatha Iyer on return from leave on the 15th. September, will join duty as Assistant in the Chemistry Section. He will however, work in the Cotton Specialist's Laboratory till further orders. D. V. Krishna Rao whose offg. appointment as Assistant in the chemistry section will terminate on 14th. September '33, will continue to officiate till 18th. November, 1933.

ADDITIONS TO THE LIBRARY DURING JUNE 1933.

A. Books.

1. Hungarian Alkali Soils and Methods of their Reclamation (California Agri. Expt. Stn. Spec. Pub.) *A J. Sigmond* (1927). 2. International Year Book of Agricultural Statistics—1930-31. *League of Nations Pub.* (1931). 3. The Agricultural Situation in 1930-31. (1932). 4. New Experiments in Electro Farming (U. P. Agri. Dept. Bull. 62). *S. Nehru* (1933). 5. The Significance of Nitrogen. *J. E. Zenetti* (1932). 6. The Sheep Blowfly in Australia. *Tillyard* (1933). 7. Evolution Considered in the light of Hybridization. *J P. Lotsy* (1925). 8. Plant Physiology: Laboratory Directions. *W. F. Loehwing* (1932). 9. New Conceptions in Biochemistry. *N. R. Dhar* (1932). 10. Fats and Oils: A General View. *C. L. Alberg and A. E. Taylor* (1928). 11. Copra and Coconut Oil. *K. Snodgrass* (1928). 12. Observations on Citrus Insects and their Control in many parts of the World. *F. E. Bodenheimer* (1932). 13. British Agricultural Meteorological Scheme—Observers' Hand Book. (1929). 14. Instructions to Observers at the Second and Third Class Observatories. *S. C. Roy* (1930). 15. The Year Book of the Universities of the Empire—1933. *H. F. Heath* (1933). 16. Guide to the Cataloguing of Periodicals. *A. L. A. Pub.* (1931). 17. Guide to the Cataloguing of the Serial Publications of Societies and Institutions. (1931).

B. Reports.

1. Scientific Reports of the Imperial Institute of Agricultural Research, Pusa—1930-31. 2. Third Report showing the Progress made in giving effect to the recommendations of the Royal Commission on Agriculture in India, during the Calendar Year 1931. Part 1.—Central Government. 3. Third Report showing the progress made in giving effect to the recommendations of the Royal Commission on Agriculture in India up to the 31st December, 1931. Part II—Local Governments and Administrations. 4. Estimates of Area and Yield of Principal Crops in India 1931-32. 5. Annual Report: Empire Marketing Board—May 1932 to May 1933. 6. The National Institute of Agricultural Botany: Thirteenth Report and Account—1931-32. 7. Twenty-Eighth Annual Report for the twelve months ending December 31st, 1932 of the British Cotton Growing Association. 8. Live Stock Diseases Report (Recording Control Work during the year ended 30th June 1932) of the Department of Agriculture, New South Wales. 9. Official Year Book of the Commonwealth of Australia—No. 23 of 1930. 10. No. 24 of 1931. 11. Forty-Third Annual Report—1930 of Texas Agri. Expt. Station. 12. Forty-Fourth Annual Report 1931 of Texas Agri. Expt. Station. 13. Fifty-First Annual Report—1931-32 of Ohio Agri. Expt. Station. 14. Forty-Fifth Annual Report of the South Carolina Experiment Station of Clemson Agricultural College for the year ended June 30, 1932.

C. Bulletins, Memoirs &c.

15. Life Histories of Indian Micro-Lepidoptera (Second Series) Alucitidae (Pterophoridae) Tortricina and Gelechidae. *Imp. Coun. Agri. Res. Pub. Sci. Monograph No 2.* 16. Soap Making as Cottage Industry in Bihar and Orissa. *Bihar and Orissa Dept. of Ind Bull. No. 5 M. I. S.* 17. An Optical Lever Siltometer. *Punjab Irr. Res. Inst. Res. Pub Vol. V—No. 1—January 1933.* 18. Resin Secretion on Different Host Plants by the Lac Insect. 19. Shellac Drying Oil Combinations. 20. Pruning and Cropping. *Ind. Lac. Res. Inst. Bull No. 11, 1932, 12, 15, 1933.* 21. Land Amelioration in Germany with Special reference to Drainage Research Work. *Imp. Bur. Soil Science Tech Comm. No. 27.* 22. Home-Grown Feeding Stuffs. 23. Fruit and Vegetable Production for Commercial Canning. 24. The Housing of Poultry. *Eng. Mini. Agri. and Fish. Bull. Nos. 13, 45, 56.* 25. Co-operative Marketing Makes Steady Growth. 26. Statistics of Farmers' Selling and

Buying Associations—United States, 1863–1931. *Washington Federal Farm Board Bull. No. 8, April 1932, No. 9, June 1932.* 27. Prehistory in the Light of Genetics by E. Clarke and J. B. S. Haldane. *Royal Inst. of Great Britain Pub.—1931.* 28. Old and New Standpoints on Senile Degeneration by A. P. C. Bijhouwer. *Special Pub.* 29. The Engineering Aspects of the Condensing and Drying of Milk. by A. W. Scott and A. M. I Mech. E. *Hannah Dairy Res. Ist. Bull. No. 4.* 30. Cytological Studies in Cotton; 1. The Mitosis and Meiosis in Diploid and Triploid Asiatic Cotton by A Skovsted. *Trinidad Cotton Res. Mem. Ser. A., Genetics No. 5.* 31. Beans; Standard Descriptions of Vegetables. *Dominion of Canada Agri. Dept. Bull No 153. New Ser.* 32. Insect Pests of Grain in Alberta. *Alberta Agri. Coll. Bull. 24.* 33. Experimental Milling and Baking Tests on South African Wheat Varieties. 34. Studies in the Keeping Quality of Fruit 1. *Union of S. Africa Agri. Dept. Sci. Bull. Nos. 116, 118.* 35 Production of Flue-cured Tobacco. *Union of S. Africa Agri. Dept. Bull. No. 120.* 36. Methods for the Identification of the Coloured Woods of the Genus Eucalyptus. 37. A Soil Survey of King Island. 38. Varieties of Wheat in Australia. *Australia Coun. Sci. and Ind. Res Bull. Nos. 67, 70, 72.* 39. Tobacco Production in Australia. *Australia Tobacco Invest. Bull. No. 3.* 40. Butter Over-run and Factors affecting it under New Zealand Manufacturing Conditions. *New Zealand Dairy Res. Inst. Pub. No. 31.* 41. Cotton Experiments, 1925–26. 42. Sugarcane in Uganda. *Uganda Agri. Dep. Cir. Nos 16, 19.* 43. Life History of the Angoumois Grain Moth in Maryland. 44. The Bonavist, Lablab, or Hyacinth Bean. 45. Motion Pictures of the United States Department of Agriculture, 1932. 46. List of Publications of the United States Department of Agriculture from January, 1926 to December, 1930, inclusive. *U. S. Agri. Dept. Tech. Bull. Nos. 351, 318, Mis. Pub. 152, 153.* 47. Transferring Bees to Modern Hives. 48. Sweetpotato Growing. 49. Commercial Comb-Honey Production 50. Beekeeping in the Clover Region. 51. Seed Potatoes and How to Produce them. 52. Black Walnut for Timber and Nuts. 53. Turkey Raising. 54. Heating the Farm Home. *U. S. A. Far. Bull. Nos. 961, 999, 1039, 1215, 1332, 1392, 1409, 1698* 55. Grafting Tropical Fruit Trees in Hawaii. *Hawaii A. E. S. Cir. No. 6.* 56. Genetics and Breeding in the Improvement of Soybean. *Illinois A. E. S. Bull. No 384.* 57. Wholesale Prices for 213 Years, 1720–1932:—Part I, Wholesale Prices in the United States for 135 years, 1797 to 1932. Part II, Wholesale Prices at New York City, 1720 to 1800. *Cornell A. E. S. Mem. 142.* 58. Field Control of Sugarcane Root Disease Conditions. 59. A Summary of the Investigations of the Sugarcane Moth Stalkborer in Cuba. *Tropical Plant Res. Found. Bull. Nos. 6, 8.* 60. A Survey of Storage Conditions in Libraries relative to the Preservation of Records. *U. S. Bur. of Standards Mis. Pubc. No. 128.* 61. Wheelbarrows: Simplified Practice R. 105-32. *U. S. Dept. Bur. of Standards R. 105-32. Wheelbarrows.* 62. The Chemical Composition and Nutritive Properties of Milk as affected by the Level of Protein Feeding. Part I, Chemical Composition. Part II, Nutritive Properties. 63. A Survey of Ohio Orchard Soils Relative to Phosphorus Distribution and Acidity. 64. Studies on the Nutritive Value of Milk, II. The effect of Pasteurization on some of the Nutritive Properties of Milk. *Ohio A. E. S. Bull. Nos. 515, 517, 518.* 65. The Quality of Vegetable Seeds on Sale in New York in 1932. 66. Effects of Fertilizers and Rotation on Earliness and Total Yields of Tomatoes. *New York A. E. S. Bull. Nos. 618, 619.* 67. The Blackberry Mite and its Control. 68. The Potato Flea Beetles: Epitrix Cucumeris Harris Epitrix, Suberinita Leconte. *Pullman A. E. S. Bull. Nos. 279, 280.* 69. The Texation of Farmers in South Carolina. 70. Texation and Ability to Pay in South Carolina. 71. An Economic Study of Sumter County Agriculture. *South Carolina A E. S. Bull. Nos. 285, 286, 288.* 72. Anatomy of Phaseolus Vulgaris, L. Var. Black Valentine. 73. Studies on the Biological Decomposition of Peat. 74. Field Studies of Sports in Michigan Fruit Trees. 75. The Rock Garden. 76. Rural School Organization in Michigan. *Michigan A. E. S. Tech. Bull. Nos. 128,* *129, 130; Spl. Bull. Nos. 228, 229,* 77. The Fertilizing Valne of Green Sand. 78. The Effect of Cotton Seed Meal and other Feeds on the Storage Quality of Eggs. 79. Relations of Buffer Capacity for Acids to Basicity and Exchangeable Bases of the Soil. 80. The Composition and Fertilizing Value of Sewage Sludge. 81. Trees and Shrubs in Northwest Texas. 82. The Mechanical Harvesting of Cotton. 83 An Economic Study of Farm Organization in the Piney Woods Farming Area of Texas. 84. Inequalities in Taxation of Farm Lands and City Property Due to Scope and Method of Assessment. 85. Grain Sorghum Varieties in Texas. 86. Probability Tables for Mendelian Ratios with Small Numbers. 87. Fig Culture in the Gulf Coast Region of Texas. 88. Quantities of Vitamin A required by Pullets for Maintenance and for Egg Production. *Texas A. E. S. Bull. Nos. 428, 429, 412, 445, 447, 452, 453, 458, 459, 463, 466, 468.* 88(a). Sorghum Crops on the High Plains of Oklahoma. 88(b). Sorghums for Grain and Forage. *Oklahoma A. E S. Bull. Nos. 191, 210.* 89: The Putting Green: Its Planting and Care. 90. Lawn Making and Maintenance. *O. M. Scott & Sons Co., Pub. Ohio. Pub. 1931, 1932* 91. Aero Cyanamid Granular. 92. Directions for Using Granular Aero Cyanamid. 93. The Cyanamid Plan for Growing Cotton and Corn. 94. The Cyanamid Plan for Growing Truck Crops. *American Cyanamid Co., Pub.*

D. Circulars, Leaflets &c.

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MODIFIED DRY COMBUSTION METHOD FOR THE DETERMINATION OF ORGANIC CARBON IN SOILS.

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The estimation of organic matter in the course of a soil study is of fundamental importance since this soil component affects markedly the physical. chemical and biological properties of the soil. Just like clay, it possesses many of the properties of colloids: it modifies greatly the readiness with which mineral plant food is rendered available to the crop and it is the medium in which the micro-organisms in the soil live and perform their functions.

The loss-on-ignition method was probably the first to be employed for the estimation of soil organic matter. But this gives very unreliable results especially when the soil– contains clay and carbonates. As a striking example could be mentioned the analysis of a sample of black soil from Hagari. This gives a loss on ignition (exclusive of moisture lost at 100°) of about 7%. Out of this there is only 0·9% of organic matter, the rest of the loss being due to carbonates and combined water. Methods employing sodium hydroxide, ammonia or hydrogen peroxide are probably useful for the estimation of particular parts of organic matter present in the soil and not for the whole of it. (1)

The majority of the methods now commonly employed are based on the determination of organic carbon by a wet or dry combustion method and then calculating the organic matter by using a conventional factor, 1·724. Allowance is made for the presence of carbonates which are estimated separately. Among wet combustion methods, the rapid volumetric procedure of—Schollenberger (2) and its modifications give at best only a rough idea depending upon the nature of the soil components and upon the state of oxidation of the organic matter. Soil organic matter is, extremely complex and exists in different states of oxidation. The presence of reducing and oxidising—substances greatly modify the validity of the results. Robinson's new method (3) using the Kjeldahl procedure suffers from the same drawbacks. Even in the simplest cases of sugars having the formula $C(H_2O)_n$. he did not get complete recovery. With such varied classes of substances as acids, fats, waxes, proteins and other nitrogen compounds the equation $C + 2H_2SO_4 = CO_2 + 2H_2O + 2SO_2$, does not find a uniformly approximate application. Under the circumstances only the direct absorption and weighing of the carbon dioxide evolved may be expected to give reliable results for the organic carbon content. Even here, wet methods using solutions of chromic acid or permanganate, give low results evidently due to incomplete oxidation, and these are only slightly less laborious than the dry combustion method which is universally recognised as the standard. Owing to the wide applicability of this dry combustion method, modifications to make it more rapid and free from any possible source of error will be very valuable and this has been the aim of the work described in this paper.

Before embarking on the estimation of organic carbon in soils, it was proposed first to work out a modification using pure organic substances of various types whose compositions have been established beyond doubt. The chief difficulties in the Liebig's combustion method are (i) slow and sometimes incomplete combustion of some complex refractory bodies, and (ii) the errors introduced by the presence of nitrogen, halogen and sulphur in the substances analysed. The first has been greatly minimised by the use of oxygen for the combustion instead of air and by using platinum boats instead of porcelain ones. Nitrogenous compounds give rise to oxides of nitrogen which get absorbed along with carbon dioxide and thus high values are obtained. Fresh, reduced copper coil placed at the exit end of the combustion tube, removes this error by reducing the oxides to nitrogen, but its use is cumbersome and tedious. Halogen compounds give rise to halogens which have been attempted to be trapped by using a U tube of potassium ferrocyanide or a similiar reagent, but the best procedure seems to be the use of red hot silver gauze or wool. Oxides of sulphur from the sulphur compounds have been attempted to be removed by using sodium chromate solution or pumice soaked in concentrated sulphuric acid. But these are not found to be effective. The most perfect solution of all these difficulties is that of Pregl (4) in what is known as the Universal filling of the combustion tube for micro-estimations. He uses a mixture of copper oxide wire and lead chromate (hempseed size) or copper oxide impregnated with the chromate for filling the combustiou tube in the place of the usual copper oxide. The lead chromate at red heat retains all oxides of sulphur effectively. Short lengths of silver wool kept at red heat remove the halogens and the nitrous fumes are absorbed by pure lead peroxide kept at the boiling point of decalene. This has been adapted for macro—combustions also by Davies (5). In this procedure lead peroxide is the chief source of trouble. It requires to be specially pure and made into a particular state of subdivision. Variations from the optimum conditions of temperature means failure of analysis. On a macro scale it is rather cumbersome to use and the constant temperature arrangement is not easily fitted up. The chief characteristics of the modification adopted in this paper and found suitable for soils in ordinary laboratories are as below :—

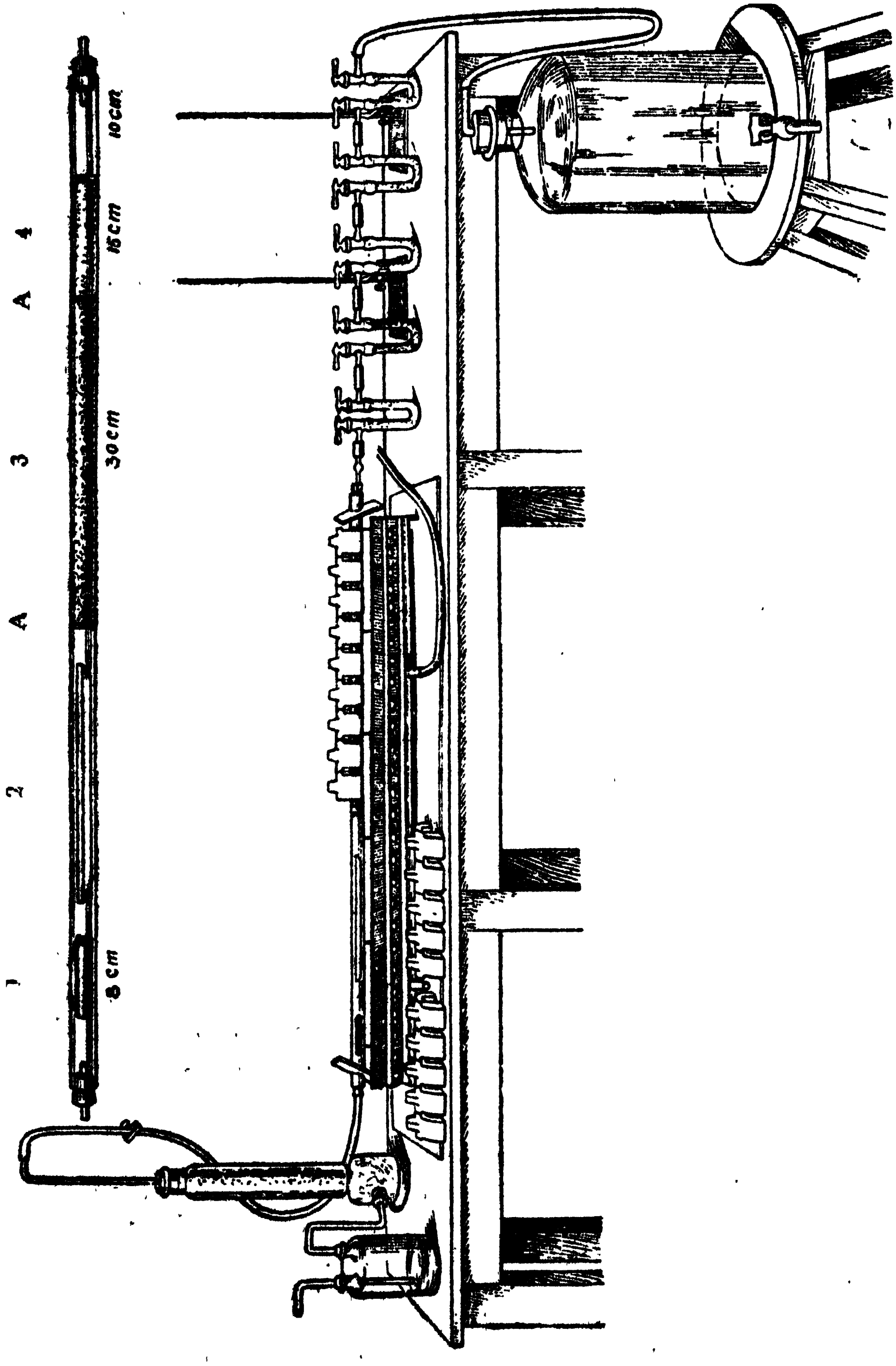
(i) the substance is mixed up with powered copper oxide and burnt at red heat in a current of air. Under the circumstances there is rapid and complete oxidation of carbon ; oxygen is not necessary for the combustion.

(ii) a mixture of well ignited wire form copper oxide and lead chromate (hempseed size) is employed for filling the tube. Oxides of sulphur are thus retained.

(iii) a length of about 15 c. m. of closely packed fine silver wire or wool at red heat serves to remove all halogens.

(iv) instead of lead peroxide and the decalene bath, a U tube containing pumice soaked in concentrated sulphuric acid has been found to be quite effective in retaining nitrous fumes. Probably the combined action of silver and sulphuric acid gives the arrangement its merit.

Materials for filling the combustion tube. A good hard glass combustion tube about 1 metre in length and 8 to 10 m. m. in diameter is chosen, the ends are softened in a flame or smoothened with a grinding stone or file and finally cleaned and dried. Pure precipitated lead chromate is moistened with water formed into a thin slab on a glass plate and cut into small pieces. This is first dried in the steam oven, transferred to a nickel basin and ignited over a bunsen burner for about one hour. At this stage the substance is in the form of irregular pieces of hempseed size. Wire form copper oxide also is ignited for half an hour in a nickel crucible over a bunsen burner. The silver



1. Oxidised Copper Coil. 2 Silver Boat. A, A. Asbestos Plugs.
3. Copper Oxide Lead Chromate Mixture. 4. Silver Wire.

wire was the thinnest that could be made out of pure silver by a local silver smith. Asbestos used for the filling was pure gooch asbestos which was well ignited in a platinum basin over a strong bunsen flame.

Filling the combustion tube. A, A are asbestos plugs about 1 c. m. in thickness. About 10 c. m. length is left empty at the exit end. The silver wire is cut into small lengths and packed closely into the tube. Used up samples are ignited in a current of hydrogen and then they are fit for use again. When the copper oxide and lead chromate are prepared as stated above, they do not require igniting in the combustion tube very long. There is then ample space in the tube for introducing the boat and an oxidised copper coil 8 c. m in length. The boat was made locally out of pure silver. It just went into the tube easily and it was about 1 m. m. in thickness. The length was between 6 and 8 inches to suit circumstances so that it easily took in the copper oxide soil mixture. It is not seriously affected during the combustion. The inside alone gets a little brown after considerable use.

The purifying and absorption trains. Before entering the combustion tube the air that is aspirated bubbles through 50 per cent. potassium hydroxide kept in a Wolfe's bottle, and subsequently through a big soda lime tower. The absorption train consists of the following:–

(i) *U tube containing coarse granules of calcium chloride for removing water*:—It was found essential to provide this with a bulb at the inlet so as to condense most of the water produced. With some clayey soils containing large quantity of water of chemical combination this was found to prolong the life of the calcium chloride considerably. Since calcium chloride is likely to contain some lime it was first saturated with carbon dioxide by connecting the U tube to a Kipp's apparatus provided with a gas washing bottle containing concentrated sulphuric acid. After passing the gas for a few minutes the outlet tap was closed and the tube left with the other end connected with the Kipp for 12 hours. The U tube was then disconnected and about 200 c. c. of air passed through in about 10 minutes so that the excess of carbon dioxide was completely removed.

(ii) *U tube containing pumice (hempseed size) soaked in concentrated sulphuric acid*:—This should contain some excess of sulphuric acid so that a little of it collects at the bottom bend and serves as a bubble counter. Since the gases coming in here are dry, the acid does not get diluted and hence is more effective in absorbing nitrous fumes.

(iii) *Two soda lime U tubes for absorbing carbon-di-oxide*:—These tubes have a few centimeteres of calcium chloride at the exit ends so as to prevent the escape of moisture from the moist soda lime. For good absorption it is essential to ensure that the soda lime is sufficiently moistened. For this purpose the substance is spread on a large piece of paper, and water sprayed from a wash bottle provided with a narrow jet. Too much of water rendering the granules sticky should be avoided. The first U tube is usually refilled when the second shows an increase of over 1 m. g. in weight during an estimation. The quantity of moisture in the soda lime limits the number of estimations for which it could be used. With one sample containing sufficient moisture the first tube was effective for more than 20 estimations and the second did not show any appreciable increase during each estimation. Whereas in another case with less moisture it could not be used for more than 6 estimations. During the combustion it is essential to wrap the soda lime absorption tubes with wet cotton, as otherwise considerable heat is generated and the soda lime loses moisture and its absorptive power is lessened.

(iv) *A U tube containing soda lime in one limb and calcium chloride in the other to serve as a guard tube. Blank test* :—Since the wire from copper oxide and lead chromate had been ignited prior to filling, the tube required only a preliminary heating of about 2 hours at dull red hot during which time about 1500 c..c. of air was aspirated. It was then ready for a combustion. Commercial copper oxide powder gives a fairly high blank even after ignition in a nickel crucible for one hour over a strong bunsen flame. This could be eliminated by keeping it at red heat in a hard glass tube for one hour and aspirating 700 c. c. of air through. Large quantities (100—150 grams) could be treated at one time and stored up for use. A blank using this copper oxide gave practically no increase in the weight of the soda lime absorption tubes.

Analysis of pure organic substances :—*Carrying out a combustion.* The combustion tube which has been filled and ignited as above is now connected to the calcium chloride and sulphuric acid U tubes and the front part containing the copper oxide lead chromate mixture raised to dull red heat.. Meanwhile the substance (about 0·1 gram) is weighed into a small clean porcelain basin mixed with 10 grams of specially ignited copper oxide and transferred to the silver boat. The basin is washed twice with small quantities of copper oxide and the washings added to the boat. The weighed soda lime U tubes and the guard tube are now connected in the front and after all the taps have been opened, the boat and the oxidised copper guaze are introduced into the combustion tube and the rubber stopper is pushed in tight. The aspirator is then connected and a very gentle stream of air is aspirated by adjusting the air inlet in the purifying train.. The oxidised copper coil is first raised to dull red heat and next the boat itself heated very slowly so as to avoid too rapid a combustion. About half an hour is an optimum time for the complete combustion. When the gas evolution has slackened considerably as judged from the bubbling in the sulphuric acid tube the air inlet is opened wider and about 350 c. c. of air aspirated. At the beginning the rate is kept slow, but later on it could be increased so that 20 c. c. is aspirated in a minute. This does not take more than one half hour so that the combustion and absorption takes just less than one hour.

Before starting another combustion the burners in the back part of the furnace containing the boat and copper gauze are turned out, the tiles removed and this portion allowed to cool as the absorption tubes are being weighed and a fresh sample got ready. It was found advisable to turn out 1 or 2 burners under the copper oxide lead chromate mixture also in order to avoid cracking of the tube when the cold boat was introduced. This precaution is specially necessary in the case of soils containing high percentage of chemically combined water. The side arms of the U tubes are cleaned inside with a little cotton the stoppers opened for a moment closed again and then weighed.

The whole analysis takes less than 1¼ hours and 5 to 6 estimations could be done in a day. The method was tested by using a number of pure organic substances belonging to typical groups. Even very refractory bodies burnt very smoothly and rapidly. Amongst nitrogen compounds, the aromatic nitro-compounds have been shown by Pregl to offer the crucial test of the efficiency of a method since they give rise to large quantities of nitrous fumes. With this method these have given quite correct values for carbon. The highly resistant sulphur compound, sulphonal offered no difficulty. The results of several repetitions with each compound were found usually to be about 0·2 to 0·4 per cent high.

Sample analytical results.

	Found.	Required.
	%	%
Cane sugar	42·3,42·1	42·1
Cholesterol	84·2,83·8	83·8
Acetanilide	71·3,71·2	71·1
Strychnine	75·8,75·4	75·5
Uric acid	36·1,35·9,35·7	35·7
Metadinitro benzene	43·1,42.9,43·0	42·8
Sulphonal	36·9,36·7,36·9	36·8
Bromoethylphthalimide	47·6,47·4	47·3

It may be suggested that for a macro method for C and H the same apparatus could be used with only this modification that instead of the admixture of the substance with fine copper oxide it has to be burnt in a current oxygen.

For the determination of organic carbon in soils the amount of the sample to be taken for analysis will depend upon the nature of the specimen. Usually enough soil is taken so as to yield about 0.1 g. of carbon dioxide. A sample passing a—100 mesh sieve is found to be convenient as thereby errors due to sampling of small quantities could be minimised. Otherwise the decomposition is equally good even with 1 m. m. mesh samples. It is mixed with 10 grams of the specially ignited copper oxide and the combustion carried out as above.

The chief difference between the analyses of pure substances and of soils lies in the length of time for which the heating is to be done. This is due to the presence of carbonates in the soils in more or less quantities. They may require longer heating and greater volume of air to be aspirated in order to complete the decomposition. Since calcium carbonate is the one most common in soils and probably the most difficult to decompose, experiments were made to find out the conditions of complete decomposition of calcium carbonate when mixed with copper oxide and ignited in the combustion tube at red heat. The progress of the decomposition was followed by stopping the aspiration of air and disconnecting the soda lime tubes at different intervals and weighing them. It was thus found that by keeping at red heat for about 45 minutes and passing 700 c. c. of air only 75% of the carbonate underwent decomposition, whereas after just more than one hour and passing 1000 c. c. of air though, the decomposition was complete.

On the other hand sodium carbonate decomposed to about 20% only under the same conditions within 1½ hours. Further decomposition was exceedingly slow. Hence this combustion method may not give quite correct results with soils which contain sodium carbonate, since the correction for the presence of carbonate in evaluating the organic carbon cannot be found out exactly.

It should be mentioned here that with all the soils mentioned below it was found that the oxidation of the organic matter and the decomposition of the carbonates could be completed by carrying out the cumbustion within one hour which involves keeping the boat at red heat for about 30 minutes and aspirating 350 c. c. of air only. The actual burning of the organic matter takes about 30 minutes and the carrrying over of carbon dioxide into the soda lime tubes takes 20—30 minutes. The rapidity of the decomposition of soil carbonates may probably be due to their existence as a mixture of various metallic carbonates. This considerably shortened the time of analysis so that about 5 to 6 analysis could be done in day.

The following soils from typical localities in South India were analysed for organic carbon. The results indicate values obtained after allowing for the carbonates which are here expressed as Calcium carbonate.

Serial Number.	Soil description.	Carbon. %	CaCo$_3$ %	Remarks.
	Dryland Soils.			
1	Coimbatore, Central Farm. (New Permanent Manurials) Cattle manure plots.	0·74, 0·74	2·27	Pale red soil.
2	Do. No manure plots.	0·59, 0·59	2·75	,,
3	Hagari (Bellary district) Soil Moisture Plots. 1st foot	0·53, 0·52	5·95	Heavy black soil.
	,, 2nd ,,	0·52, 0·54	6·55	,,
	,, 3rd ,,	0·50, 0·50	6·84	,,
	,, 4th ,,	0·52, 0·52	7·34	,,
	,, 5th ,,	0·59, 0·58	8·27	,,
	,, 6th ,,	0·49, 0·46	8·59	,,
4	Koilkuntla (Kurnool district).	0·53, 0·51	3·32	Black soil.
5	Palakkuppam.	0·35, 0·35	0·39	Red loamy soil.
	Wet Land Paddy Soils.			
6	Coimbatore, Central Farm. Green manure plot.	0·74, 0·74	0·41	Puddled with green manure. Heavy soil.
7	Vedapatty, Paddy Breeding Station, Coimbatore.	0·73, 0·73	0·93	,,
	Estate Soils.			
8	Upper Parlai Estate, Valparai.	2·66, 2·69	0·32	Pale red soil.
9	Arnakal Estate.	2·00, 1·96	0·14	,,

This work was done in the Chemistry Section of the Agricultural Research Institute, Coimbatore and the author expresses his thanks to the Govt. Agricultural Chemist for facilities offered.

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(2) ,, 24, 65.
,, 31, 483.
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SUGARCANE INSECTS AND PROBLEMS CONNECTED WITH THEM IN SOUTH INDIA*.

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Introduction. In the Madras Presidency, sugarcane is cultivated in all the important agricultural tracts, and at present, the area under this crop occupies somewhere about 126,000 acres.

The latest available crop statistics show the following distribution of cane area in the Presidency.—N. Circars 48,750 acres; Central districts 44,500; Carnatic including Nellore, Chingleput and S. Arcot 12,850; the Ceded Districts 11,700; the Southern districts 3,800; West Coast and Hills 3,620. For the whole of India the area under cane during 1931—32 has been noted to be 2,886,000 acres; over 50% of the sugar products is from the U. P .

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* Note prepared as a member of the Committee for preparing a Sugarcane Pest Research Scheme, which met at Simla on 7th August 1933.

Of this total area, over two thirds of the acreage is confined to the Northern Circars including the Ganjam, Vizagapatam, Godaveri and Kistna Districts and the central tract including the districts of Chittoor, North Arcot, Salem, Coimbatore and Trichinopoly. As a result of the recent inducements to develop the Sugar industry in the shape of tariff protection, and the opening up of several irrigation projects in the different provinces, there are indications to show that the existing area under sugarcane is sure to increase considerably during the coming years, and that the problems connected with this industry are sure to assume more and more prominence in the near future. And of the various such problems, those connected with the animal and vegetable parasites which levy their toll on this important crop, are no less important. According to Fletcher, the damage done by cane borers alone is roughly estimated at 30 million rupees a year. Though this estimate may not be quite accurate, it gives us some idea of the loss by pest infestation, and reminds us of the fact that this aspect of the sugar industry is well worth a thorough investigation at the hands of scientific men and sugarcane cultivators. This note is prepared with the idea of presenting in a brief manner the present position regarding sugarcane insects in S. India, their comparative economic importance, and the chief problems connected with them which the sugar planter has to deal with. As far as possible, scientific details and technicalities have been avoided.

Sugarcane pests in S. India. Though the area under cane in S. India is far less than in some of the Northern Provinces and the damage caused to the sugarcane crop by insect and other pests is not so pronounced as in the case of crops like paddy or cotton; sugarcane often suffers at the hands of such pests and diseases, and appreciable damage and loss are caused thereby. To the sugarcane farmer who is anxious to grow a good crop and reap a decent harvest of vigorous, vermin-free and healthy canes, a knowledge of the nature and habits of the more important pests, and some familiarity with the possible control measures against them, will always be of very great help. And now that the area under sugarcane is increasing rapidly, information in this direction might be of great use and very much appreciated. With regard to cane insects with which only this note deals, though a dozen or more insects have been found associated with the sugarcane plant in the different tracts of this province*, not more than three or four could at present be put down as forms which might be considered as serious major pests; the others are ordinarily of minor importance and become serious only very rarely, causing sporadic local infestations.

The Major Pests. The most important pests of sugarcane in S. India which may be ranked as the foremost and which generally cause appreciable damage are the Moth borers and Termites, and it is only in connection with these two sets of pests that the Entomologist very commonly receives complaints and reports. As next in importance to them, we may include the two or three sucking insects which occasionally appear as pests, *viz.*, the cane mealy bug, the mealy wing and the leaf hopper.

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* *Vide* author's bulletin on List of S. Indian crop pests—Madras Department Bulletin No. 27 (1932).

The Moth Borers— Of the insects associated with sugarcane, the borers of one or other species are very ancient and well-known pests of this crop, being found in almost all the sugarcane areas of the world; and unlike other insects which have often a local or restricted distribution, the moth borers are very cosmopolitan and practically perennial pests of the crop: the only point to be noted is, that the species in different countries are not the same. The species chiefly concerned in the West Indies, Lousiana, Mexico and British Guiana is *Diatroea saccharalis*, F. Of the three or four species of sugarcane moth borers found in S. India, the only important one is the insect known by the name *Argyria sticticraspis*, H. Though this insect has been known for a very long time it was not until very recently that the correct identification of this borer was obtained. For many years past this insect was confused with one or two similar borers which very closely resembled this species and had practically the same life habits; and all these passed under the same name *Chilo simplex*, B, since all these allied insects were found breeding on sugarcane, sorghum, maize and allied plants. Recent work on this insect and other allied borers, especially done in Pusa†, has clarified this confusion to a certain extent, and as far as we know, our most important moth borer pest of sugarcane is now definitely identified as *Argvria sticticraspis*, H. Though found on allied plants it is particularly partial to sugarcane and attacks the latter usually during the very early stages, causing '*dead hearts*' in young plants; it does not infest grown up canes so much as those in the younger stages. This insect may be considered as the most important of sugarcane pests in the province. Another borer which is said to attack the upper portwind of cane in Java* (*Diatroea venosata*, W) and which has practically the same habits as *Argyria* is not so common as the latter and is generally found attacking grown up canes and causing comparatively much less damage. The white top shoot borer (*Scirpophaga nivella* F), is another very easily distinguishable, cream-white moth with quite different habits and found occasionally in Circars, S. Arcot and Coimbatore. The caterpillar, unlike as in other forms, burrows down into the top shoots of the grown up cane, kills the central shoot and often causes the peculiar bunchy side shoots which indicate the presence of the pest in the field. Though this insect is mainly confined to sugarcane as its food plant and does not breed on sorghum and other crops like the two previously mentioned forms, it has rarely assumed the status of a serious pest so far. Another borer worth noting in connection with cane, is what is known as the wheat stem borer in N. India and the *ragi* Pink borer (*Sesamia inferens*, D) in S. India. In S. India it is a specific pest of *ragi* and maize and is found breeding on sugarcane only occasionally; the caterpillar has a pinkish color and the moth is a member of a different family from the other borers noted above, and does not strictly come under the category of what are considered as typical moth borers.

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† *Vide* papers in the Reports of 3rd and 4th Entomological Meetings—Pusa—by Fletcher & Ghosh.

* [Hert] Ren Apptry June 1933 p. 274.

Termites. Next to the moth borers we may place the termites as cane-pests of some real importance. Two species have so far been found connected with injury to cane, *viz.*, *Odontotermes obesus*, R., and *Eutermes heimi*, W. The great bulk of the damage caused to sugarcane by white ants is to planted underground setts; these are entirely eaten up hollow and the germinating buds completely destroyed in many cases. This happens especially in white-ant-infested and comparatively dry areas and this kind of damage is due chiefly to the work of *O. obesus*, R., a very widely distributed termite in S. India. Serious and whole-sale losses of seedlings are often reported from different parts, especially from newly planted and termite-infested tracts. The other species (*E. Heimi*, W) is a leaf eater and swarms of these appear late in the evening on young seedlings, cut out pieces of the leaf blades and strip the leaves outright, skeletonising the few leaves of seedling canes. This kind of damage is often particularly bad in the nurseries raised in the Sugarcane-breeding Station at Coimbatore where very young seedlings are raised from seeds.

Minor Pests. Among the insects of secondary importance as cane pests in S. India, we may include in the order of their importance, the *mealy bugs*, the *mealy wings* and the *cane leaf hopper*; all these are sucking insects and are not internal feeders like borers. The damage done by mealy bugs consists in colonies of the small insect in different stages attaching themselves to the nodes of the growing cane, sucking up the juice and allowing the plant to lose its vigour and in bad cases to fade away. Generally these are small pale reddish creatures covered with a white mealy bloom and found partially protected by the drying up leaf sheaths at the nodes, and this protection hides them from exposure. Often, these creatures are carried in setts used for planting and get distributed from place to place. Of the species known from S. India, the commonest appears to be *Ripersia sacchari*, *Gr.* (Fig.) though the species *Aclerda japonica*, N., is occasionally noted. The mealy wings and the leaf hopper are found on the foliage, where they cause the same kind of harm as the mealy bug, by sucking up plant juice, thus draining away the nutrition from the growing plants and causing them to fade. The mealy wings found, include two species

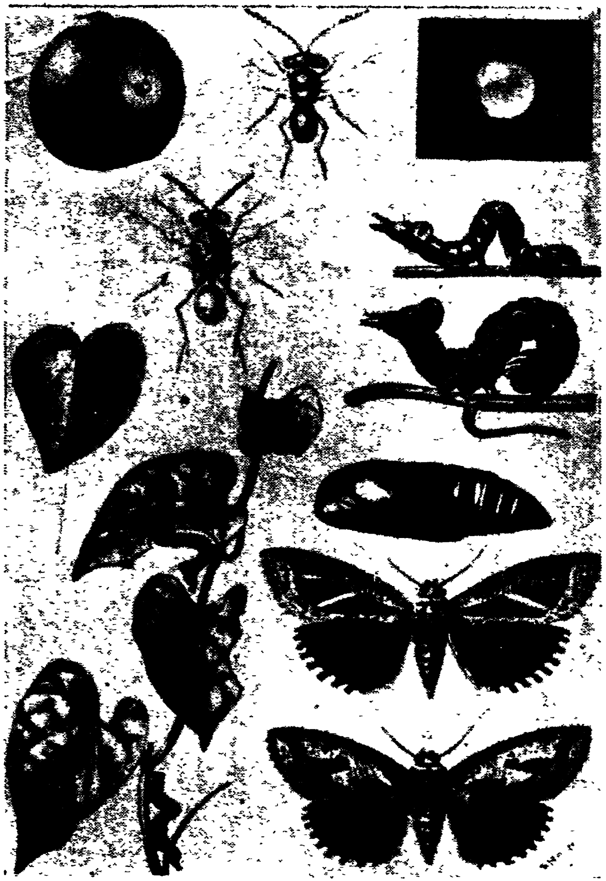


FIG 1. The Fruit-moth ; its stages and parasites.

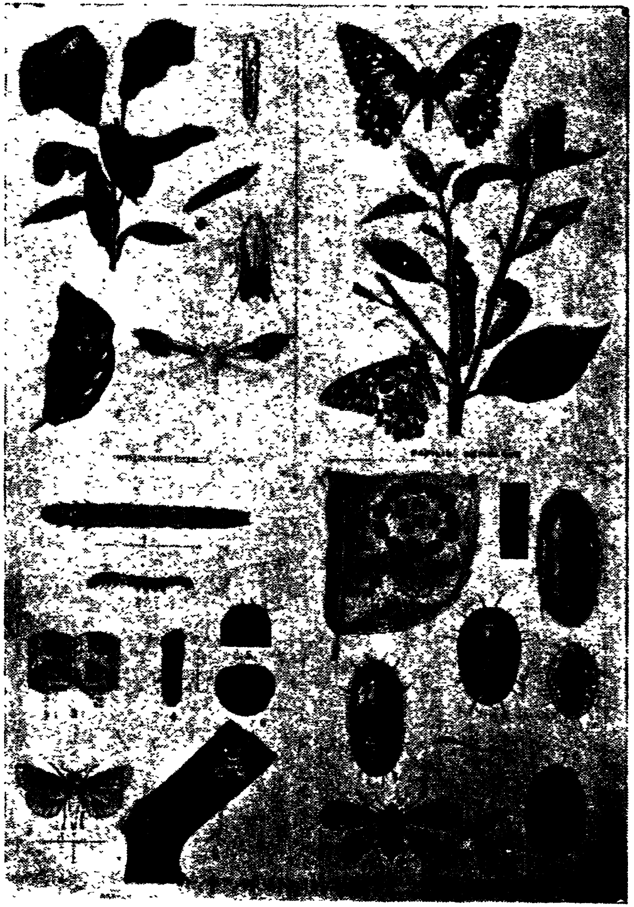
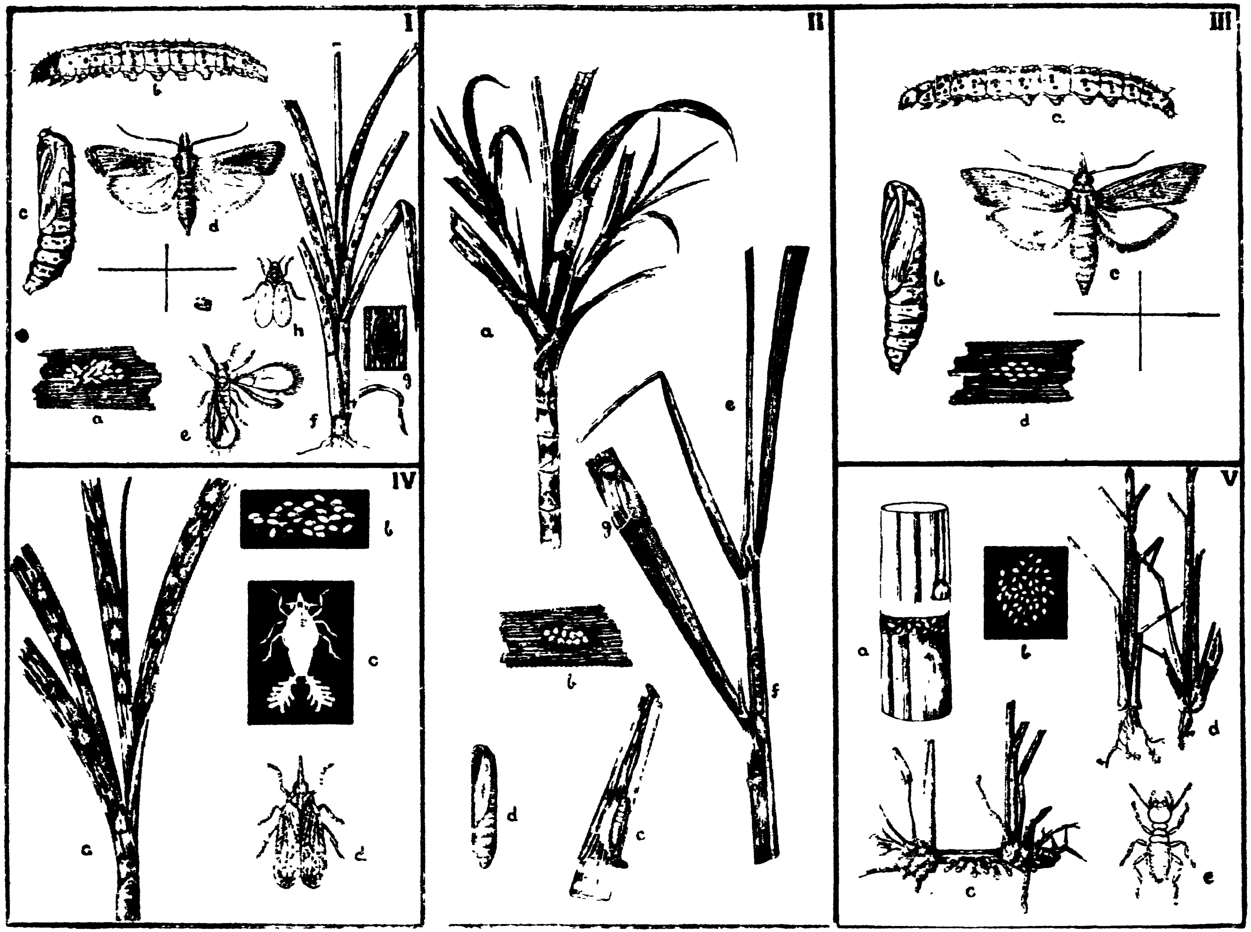


FIG 2. 1. The Citrus Leaf-miner ; 2. The Lemon Butterfly ;
3. The Citrus Bark-Borer ; 4. The Citrus Mealy-wings.

SUGARCANE INSECTS OF S. INDIA



I. (a) Eggmass of *Argyria sticticraspis.*
(b) Larva of Do.
(c) Pupa of Do.
(d) Moth of Do.
(e) *Trichogramma minutum,* R. (egg parasite).
(f) Cane showing central shoot drying and leaves infested with mealy wing.
(g) Puparium of mealy wing.
(h) Adult mealy wing.

II. (a) Cane shoot showing attack by white top shoot borer with moth on it.
(b) Egg group of white borer (*Scirphophaga*).
(c) Pupa of Do in stem.
(d) Pupa enlarged.
(e) Plant showing attack by pink borer (*Sesamia inferens*) with larva in stem.
(f) Moth on plant.

III. (a) Larva of *Diatroea venosata.*
(b) Pupa of Do.
(c) Moth of Do.
(d) Eggs of Do.

IV. (a) Plants showing *Pyrilla* infestation.
(b) Eggs of Do.
(c) Nymphs of Do.
(d) Adult bug.

V (a) Cane showing mealy bugs on node.
(b) Young larvae of mealy bugs.
(c) & (d) Termite attack on setts and plants.
(e) Termite enlarged.

Aleurolobus barodensis, M., and *Neomaskellia bergii*, S. though the former is the commonest (see Fig.) and has a very wide distribution all over India; the bluish-black puparia of this insect are often found in numbers on the foliage of grown up canes in certain tracts, and this often gives a blighted appearance to the leaves. The cane leaf hopper (*Pyrilla perpusilla*, W) is a very active straw colored bug, with the head prominently drawn forwards as a sort of rostrum (Fig.). In certain seasons and tracts, the insect increases in some numbers and colonies of the same in its various stages are found causing appreciable damage to the tender foliage of sugarcane plants. This insect may to some extent, be compared with the frog hopper pest of Trinidad and the cane leaf hopper of Hawaii, though our insect has not as yet assumed the role of either of these two serious exotic pests. Since preparing this note, the writer has received two reports of serious damage by this insect—one from Salem and one from the Nellikuppam Distilleries sugar farms. The pest in the latter case was found rather serious and organised control measures in the shape of eggmass collecting, bagging and light traps were suggested. Masses of eggs, and colonies of the hopping nymphs may be found in badly infested fields and generally, the eggs are found badly parasitised.

The other insects associated with sugarcane in S. India include one or two leaf caterpillars,[1] a leaf eating beetle,[2] a species of thrips,[3] and a species of root aphid.[4] The leaf caterpillars and the beetles have never been noted as serious so far; the thrips, which attack the tender foliage and cause the peculiar rolling and wriggling of the leaf tips, occasionally cause the leaf tips to dry, but is very rarely serious. The same can be said of the root lice also, which now and then damage the roots in some areas. The rice grasshopper[5] though known to be a pest of cane in parts of N. India, is not generally found to be serious in this province: it might, as in parts of Ganjam, do some occasional damage to cane growing in the midst of paddy on which the insect is a very serious pest.

Before closing the remarks on cane insects, mention has to be made of the notorious *Aphis maidis*, F., which is said to be responsible, as the vector, for the mosaic disease of cane which is not absent in S. India. This insect is commonly found on cholam and as far as the writer is aware, it has not been found in any notable numbers on cane in S. India

Problems Connected with Sugarcane Insects. The entomological problems connected with sugarcane in S. India are mainly, if not solely, those relating to the investigation and control of the *moth borers* and the *Termites*. Recent studies carried out by the Entomological staff of the Madras Agricultural Department especially in the N. Circars, have shown more than anything else that the only borer with which we in S. India have to seriously contend against is the species *Argyria sticticraspis*, H. This borer is present in all the important cane tracts like the Northern Circars, Coimbatore, Ceded Districts, S Arcot, etc. The extent of damage done by this borer to the primary shoots often ranges from 10 to 30 per cent. or more in certain years. The intensity or otherwise of the infestation often varies with seasonal changes taking place in the area in addition to the different varieties of cane grown. The infestation generally takes place from the period of germination up to a period of 5 weeks. and it is during this period that dead-hearts appear in the infested fields. Though the results of work so far done show in many cases a final difference of 10 per cent. in favour of borer free canes, the writer is of opinion that the actual loss finally caused to the cultivator by this insect does not very much depend upon the percentage or degree of infestation of the primary shoots. For, in some cases, the final out-turn from badly infested fields have been found to be much more than that from fields which were comparatively free or very mildly infested in the early stages. There is one important factor which has to be taken into account in investigating the subject of borer attacks in the early stages of cane, and that is, the tillering properties of canes and the consequent power they often possess of picking up vigour during their growth for 8 or 10 months after initial borer infestation, and regaining the standard output. Though some substantial work has been done in estimating the loss caused by the borer and data have been collected, it is believed that a good deal of further work has to be carried out to ascertain definitely the actual loss caused by moth borer attack to different canes and in important cane growing tracts. In this connection it will not be out of place to quote the pertinent remarks* of Dr. Myers on this question of determining the loss by borer attack.

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[1] *Telicota augias*, L. (a butterfly)

[2] *Phidodonta modesta*, W. (a small spiny black beetle).

[3] *Bregmatothrips ramakrishnae*, B.

[4] *Tetraneura ulmi*, V. G.

[5] *Hieroglyphus banian*, F.

> "What we most clearly lack, however, is a standard method of estimating infestation and from that, determining damage so that figures from different fields and different countries can be legitimately and conveniently compared so that we may, in some manner keep our thumb on the pulse of moth borer destruction, and really observe whether our own or our neighbours' attempts at control, are having any effect and if so just how much ".

We have therefore to devise some standardised methods of estimating borer injury to cane to get at the real loss caused. A good deal of ecological study has also to be done in connection with the moth borers in the relation to cane varieties, seasonal changes, alternate host plants, temperature, humidity changes in cultural practices and other factors including the nature and activities of natural enemies.

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* International Sugar Journal—October 1932. p 377.

Regarding trials of control methods a good deal might be done in the way of prophylactic measures. Of these, the selection of healthy setts for seed is a very important one; for unless this is very carefully done we will be planting the borers also when we plant the seed cane! Trials with insecticidal methods of killing with arsenicals, fluosilicates etc., have not shown any encouraging results; nor has the time arrived to suggest such measures to Indian ryots. Niether the adoption of trash traps nor the method of egg picking has been found of any avail as effective or practical control propositions. There is a good field, open of course to cane breeders, to help the ryot by breeding and evolving out borer-resistant varieties and such work is being carried in all the important cane growing areas of the world. Coming to the method of biological control, it is known that the borer is subject to the attacks of some hymenopterous parasites, some of which are present in most areas*. However, it is not yet definitely known whether their work of checking the borer has been sufficiently evident and satisfactory. Speaking especially of the biological method of control with the egg parasite *Trichogramma minutum*, Ry. (Fig.) now being adopted in various parts of the world, though it has been boomed by some in different countries as a remarkable success, there is a concensus of opinion among the more responsible men concerned in this work that this method of control has not as yet been found very convincing. This may be gathered from an important resolution† adopted on biological control by the meeting of several eminent entomologists at the Fourth Congress of the International Society of Sugarcane Technologists held in March 1932 at San Juan in Porto Rico. The resolution was to this effect: " In view of the great publicity which has been given to costly attempts in various parts of the world to control the cane moth borer by mass breeding and liberation of *Trichogramma* egg parasite, and in view of the fact that entomologists who have been engaged in this work on a comprehensive scale are in wide disagreement as to the practical results, if any, of this method, this Congress, after examination of all published evidence cannot endorse the plan, until answerable statistical evidence of its efficacy is forthcoming." This weighty statement does not, of course, mean that further investigations should not be continued in this line, but only goes to show that the work with parasites is not after all as easy and smooth sailing as some of us believe: in the words of Dr. Howard " one's outlook becomes more or less confused when one considers the complications" connected with such work. Coming to the direct methods of control, cutting out the dead hearts in time, to check the multiplication of the borer at the very early stages might deserve a

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[*] In S. India we have one or more braconids of the genera *Stenobracon* and *Apanteles* and of the Ichneumonids *Xanthopimpla* and among Scelconids a *Phanurus* and of the chalcids we have the now well-known and famous wasp *T. minutum R.*

[†] Inter sugar, gl. October 1932 p. 379.

word or two. The borer which attacks the cane during the younger stages can be controlled to some extent by prompt destruction of the shoots with dead hearts; but in most cases the cultivator is either indifferent or the operation is done very unsatisfactorily by only pulling out the dead shoot and leaving the borer in tact! In the N. Circars where there is the method of wrapping and supporting the growing canes, some of the side shoots are removed as a cultural practice during the operation; if in this process the farmer takes some care to specially cut out the infested shoots with the borer *in situ* and destroy them, a certain amount of control could also be effected. One unfortunate fact in connection with the cane borers is that, in most of these cane areas, there is sugarcane growing at some stage or other throughout the year for the pest to pass over from season to season and help its perennial multiplication. As suggested above, we have to carry out first and foremost an intensive study of the bionomics of the different moth borers to gauge the actual loss caused by each and then experiment with different control measures before we are in a position to suggest any methods of an economic and practical nature to the ryot.

The Termite problem is not half so important or serious as that of the borers which are often described as "the hardy annuals if not perennials among the pests of sugarcane". Proper selection of termite free area for cultivation, sufficient culture of the land, proper irrigation and other prophylactic measures like selection of healthy seeds and treating the setts with deterrent substances would certainly keep away termites, and even if they occur there are methods which can check their damage in the shape of soil fumigation by mixing the irrigation water with tar water or Crude oil emulsion. A radical method for termite in any area is to locate the termite nests in the vicinity, dig out the nests and destroy the queens, and in the case of the leaf feeding termite in cane nurseries the plants may be sprayed with a dilute solution of some deterrent like Crude oil emulsion. In this work, of course, proper identification and habits of the termites concerned is an essential preliminary since errors are very often made in mistaking one species for the other and applying the wrong treatment.

Regarding the other insects—only the Mealy bugs, Mealy wings and the Leaf hopper occasionally call for attention though they have been noted rarely as serious pests in the province. As in the termites some preliminary work has to be done in identifying correctly the mealy bugs and mealy wings responsible for the damage on cane in the different tracts before adopting the appropriate measures suited to each form. For mealy bugs, the selection of clean setts is of very great importancce. Some of the other measures suggested by Hall* for the Egyptian mealy bug may also be tried. The mealy wings and the leaf hopper which are leaf pests, occasionally appear to do some harm in certain seasons but prompt mechanical methods may be found to check these pests to a great extent. Both these kinds of insects are also subject to the attacks of some effective parasites.

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* The outbreak of *Pseudococcus sacchari*, C., on sugarcane in Egypt by W. J. Hall.—Teachnical and Scientific bulletion, Cairo, 1922. There are some records of the existence of this bug on cane in some parts of India but this has to be definitely ascertained.

Suggestions For Future Work. In the opinion of the writer, the following appear to be the more important items in research work connected with sugarcane insects in India.

(i) A complete survey of the insect fauna of the sugarcane plant in different parts of India and Burma; this should include the geographical distribution, original habitat, different food plants, natural enemies, life history notes and the economic importance of each insect. This would give us the correct identity and the distribution of each of the different borers etc.

(ii) A detailed study of the behaviour of the more important cane pests of each tract with special reference to such factors as the time of planting, manurial response, spacing, tillering with reference to varieties, etc.

(iii) The exact nature and the correct estimate of the damage caused by each pest both in relation to different localities and varieties of cane.

In Madras, such special studies are to be devoted to the *borers, termites, mealy bugs* and the *leaf hopper.*

(iv) The study of sugarcane mosaic in relation to insects as vectors.

(v) Trial of remedial measures including Prophylactic, Cultural, Mechanical, Insecticidal and Biological methods. Special attention may be devoted to the study of natural enemies and methods of biological control according to modern technique. These may be carried out in ways which will suit the different local and economic conditions in the different tracts of India.

(vi) Trials in evolving varieties of cane which may be pest resistant, in co-operation with breeders.

Thus, the investigations relating to cane pests have to be carried out with due regard to all the different aspects of the subject; it may not be a wise policy to depend on one set of activities alone to get quick and satisfactory results. It is all very easy and convenient to remark glibly to an audience that the easiest way of fighting disease is by a change of variety and dispense with Entomologists and Mycologists; or to opine that Biological control is the only successful remedy against pests. But responsible workers all over the world, realising, as they do, the short-comings of such one sided activities in relation to the time factor, economy etc., appear to be of opinion that we cannot depend upon one or two factors alone and wait for the results, but should explore all avenues of attack until we have found out the most suitable measure for each pest and region. Our main aim is to help the sugar planter as quickly and economically as possible.

Before concluding this short note the attention of entomologists and others interested in the sugar industry in India may be invited to the fact that, while we are engaged in devising ways and means to fight our local pests, we should not forget to provide ourselves with the proper precautions which will prevent the entry of the some of the serious sugarcane pests of other countries such as the sugarcane weevil[1] of Australia, the dreaded leaf hopper[2] of Hawaii, the frog hopper[3] of Trinidad, the cockchafer[4] of Mauritius or the widely distributed moth borer[5] of the West Indies—insects which have been causing very serious losses to the sugar industry in their respective countries. It is needless to add that in these days of rapid and convenient transportation facilities, animals and plants have very good chances of getting widely dispersed from place to place. I believe some of us are already aware of the fact that on two occasions the Imperial Entomologist, Pusa, while examining parcels of sugarcane setts received from abroad, came across the live grubs of the West Indian sugarcane weevil (*Sphenophorus sacchari*) in a parcel from Antigua and that of the Javanese beetle pest (*Holanaria picesens*) in a parcel from Java. It is incumbent on us, therefore, to see that two objectives are kept in view, viz., the control of the existing pests on the one hand and the prevention of exotic pests from entry. For, while we are engaged in solving our own insect problems connected with sugarcane, we should also be careful to see that no exotic pests of any kind get entry into the country and add to our already existing troubles.

NOTE ON THE CULTIVATION OF PINE APPLE ON THE LOWER PALNI HILLS

By A. M. MUTHAYYA NATTAR, L. Ag.,

Agricultral Demonstrator, Dindigul.

The cultivation of pine apple, was first introduced on the lower Palni hills about 18 years ago by Mr. Bell, who was working as a coffee expert under Messrs. Stanes & Co., who then managed large estates both on Sirumalai and lower Palni hills. He introduced an Australian variety and it was propagated later on carefully by the Roman Catholic Missionaries in their estates on the hills. However, the crop was abandoned by them later on, owing to considerable damage done by wild pigs to it. With some difficulty an Indian Planter Mr. P. W. A. Marimuthu Nadar, managed to secure some plants through Mr. Bell in the year 1912—1913, and planted them in his bungalow compound on the hills. He gradually extended the cultivation. Finding this growing successfully he laid out a pine-apple plantation in the year 1920 and made known the availability of fruits by sending them to important markets. To-day there are 10 acres under this crop in his estate, compactly fenced all round by stone walls of 3 to 4 feet height to prevent the entry of wild pigs into this garden.

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[1] *Rhabdocnemus obscurus*, B.

[2] *Perkinsiella saccharida*, P.

[3] *Tomaspis saccharina*, D.

[4] *Phytalus smithi*, A

[5] *Diatraea saccharalis*, F

It is cultivated on the slopes of the hills at a height of nearly 3400 to 4000 feet above the sea level. The total rainfall in the region ranges from 60 to 65 inches per year. Except during the three or four hot months in the year, this portion of the hill has a fine climate. It is also cultivated in the midst of coffee estates where the tall silver oak trees provide them shade and thus in a way reduce the temperature even in the hottest part of the year.

The Soil. The nature of soil is gravelly on the upper portions of the slope with good black loam inter-mixed with organic matter. resting on a rocky bed below at a depth of one to two feet. The soil in the lower portion of the slope is a very rich loam mixed with small stones resting on a rocky stratum 3 to 4 feet below. Originally the whole region was under hill grass called Pothai growing to a height of four to five feet. This grass is generally used for thatching houses. The region under this grass is generally considered not suited for coffee, the soil being rather shallow. Hence this was taken up for Pine Apple growing.

Preparation of the Land. The hill grass was first burnt and then the stumps were lifted by mammutties and allowed to dry well during the summer. They were again burnt and the ash was well spread over the area. The whole area was then dug to a depth of one foot by mammutties. The stones obtained were as far as possible, usefully employed in building up the wall to form a protective fence. A portion of the stones thus collected, was used for terracing which protected the surface soil from erosion during heavy rains. There are three such terraces in a plot of 10 acres to a height of 1 to 1½ feet above the ground level. The clearing of grass jungle cost nearly Rs. 25/- per acre; while the digging of the land for the planting of suckers cost nearly Rs. 10/- per acre in the first year. The cost of removing the stones depends upon the nature of the land selected. However this particular, planter, has spent nearly Rs. 2500/- for removing the stones and utilising the material for constructing a stone wall along the boundary in a plot of 10 acres.

Selection of Suckers for Planting. Vegetative propagation is the general method adopted in the cultivation of this crop. The offshoots called suckers are removed from old plants for planting. The suckers on the tops of the fruits as well as the whoral of suckers just at the bottom of the fruits are generally stunted in growth, with stout narrow serrated leaves. These suckers are generally avoided for planting, as they are slow growers taking nearly 2 years for bearing fruits. The suckers coming up from the underground portion of the stems are always long and slender with long narrow and smooth leaves. Even these are avoided for planting as they are far more slow growers, taking more than 2 years to bear fruits. But the suckers appearing at the axils of leaves just 2 or 3 axills below the top of the flower stalk are selected for propagation. These suckers are robust with thick long stems bearing broad and tapering leaves. Thus out of 4 types of suckers coming up from any old plant, only those arising at the axils are selected for propagation. These suckers come to bear fruit much earlier than the other type of suckers. However the period of fruiting even in these suckers depends upon their age from the period of their inception from the axils. It is generally observed that 6 months old suckers bear fruits in a year. Such suckers will be about 1½ ft. in height. The same character has been observed even in the case of plantains on the hills.

Planting. The whole area is marked both length wise and cross-wise by rope at 4' apart and small pegs are driven at each point of crossing of the ropes. Pits 1 × 1 × 1 are opened at the places of the pegs. The suckers are just planted in the pits and covered with loose soil. Thus about 1200 to 1300 suckers are required to plant an acre. The cost of opening pits after marking is Rs. 10/- per acre, while the charges for collecting and planting of suckers comes to nearly Rs. 3/- per acre. After planting no irrigation is given in the hills. The planting of suckers is generally done in Chitrai (April - May) on the hills when summer showers are usually received. It is during this period that the hill plantains are generally planted on the hills.

After Cultivation. During the first year, only one hoeing is given just after rains. But in the subsequent years the whole crop is hoed thrice in a year at the end of every fourth month, at a total cost of Rs. 15/- per acre per year. Each plant is earthed up during the time of hoeing.

Removing Suckers. Along with hoeing and particularly just after harvest of the fruits, the suckers except those at the top of the fruits as well as those at the axils of the stems, are invariably removed. This operation is done with a view to prevent the unnecessary wastage of nutrition from the mother plants. But it gives full opportunity for the proper and quick development for those suckers which would form the future mother plants.

Manuring. This crop has not been manured in the garden ever since it was started. The cost of manuring a crop on the hills is prohibitive owing to enormous cost of transport of the manure from the plains. Under such circumstances the planters do not ordinarily manure other crops except coffee on the hills.

The Harvest. The formation and development of fruits, generally depend upon the age of the suckers as stated above and also on the fertility of the soil. As the soil on the slopes of hills varies in fertility and depth, all the plants do not come to bearing in the first year alone. A fair percentage of the plants bear fruits in the first year. The remaining plants bear fruits in the following December—January. Thus two yields are obtained from the crop in a year on the hills. However the heavier yield is obtained from the main season crop. Even from the season crop the maximum yield is obtained in the months of June—July. The harvest of fruits is regularly done at the interval of one week commencing from April and it is finished by the end of August. The proper maturity of a fruit is indicated by the development of external yellow colour from the bottom portion of the fruits. When the yellow colour spreads up to three-quarters, the fruits are harvested and sent to the plains for sale. Till they are disposed of either locally or in the market the fruits are arranged on the floor in rows with the top suckers. The cost of picking out the fruits from the fruit stalks and carrying them to the plains works out at the rate of Rs. 10/- per 1000 fruits.

Taste. The pine apple requires full 6 months for proper development and maturity from the period of its appearance, on the flower stalk. The seasonal changes during the long period of development have been found to cause marked changes in the taste of the furits. The prevailing of heavy dew on the hills before the summer crop of December - January, has something to do with the taste of the fruits. Thus the summer fruits always taste more sour than season fruits. The taste of the fruit depends also on the nature of soil. Pine apple growers' experience is that pine apple grown on the lands cleared of grass jungle is always more delecious than the fruits of the same variety grown in other parts. (i. e) after clearing the forest. The fruits grown on the grass regions, are found to possess a golden yellow colour when fruits are cut open whereas they look rather white in fruits procured elsewhere. (It may be worth mentioning in this connection that Mr. H. G. Stokes, the finance Member to the Government of Madras, after the lapse of long interval, recognised this variety from its golden yellow colour of the *perianth.*) Thus it seems clear that the golden yellow colour of the fruits always indicates the delicious taste of the fruits. However the constitution of the hill grass called 'Pothai' is not known. The salts left after burning the grass may have something to do with the taste of the fruits grown over this jungle cleared of this grass.

Keeping Quality. The fruits can keep, generally for a week. But the keeping quality of fruits can be increased upto 10 days, if the suckers at the top of the fruit are not removed and the fruits are stored without overlapping. If the suckers are removed, the fruits can keep barely for a week.

Size of Fruits. The size of the fruits become smaller as the age of the garden advances. In this particular garden the fruits used to weigh 4 lb. to 5½ lb. till the garden was 7 or 8 years old. Thereafter the size of the fruits is gradually getting smaller in size. Now the original plantation is about 13 years old but still the fruits weigh upto 2½ lbs. It is worth mentioning, that this garden has not been manured all these thirteen years. On inspection, I find this now not in prosperous condition; it is high time that that garden is cleared and fresh area brought under this crop. Thus it may be stated that a garden of pine apple, under ordinary circumstances, can be continued with profit upto 12 years on the hills. The planter, has been advised however to apply the mixture of neem cake and fish manure to a portion of 2 acres, during the next season and to see how the bearing is.

Variety. The variety just grown on this hill, though resembles the well known 'KEW' variety, grown in the west coast, has different characters. Both resemble in one respect having smooth leaves with the top leaves incompletely serrated. But they differ in the following points (i) The kew variety is more robust and produces much longer leaves than this variety. (ii) The midrib region of the leaves is dark pink coloured in kew variety, while it is yellow coloured in this variety. (iii) The perianth of each fruit of the pine apple is surrounded with light pink colour even in the mature stage in the kew variety, while it is golden yellow in this particular variety. The same planter has recenty planted some 16 suckers of the kew variety obtained from Punalur on the west coast in a new garden of 2 acres devoted for this cultivation. They are just bearing fruits and one can very easily mark the kew variety from the other. Thus it seems that the variety originally cultivated by this planter is altogether a different one.

Marketting. This planter was it appears careful in removing the top suckers before the produce was sent for marketting. His idea was to reserve all material for extending the cultivation of this variety only in his estate. Thus he managed for 8 years and prevented the spreading of this variety both on this hills or anywhere else. Once he extended the plantation and brought the area to this desired extent, he did not mind sending the produce with suckers on. He has also been freely supplying suckers to others thereafter.

Besides supplying the markets of Madura and Tinnevelly, these fruits are transported to Kumbakonam, Tanjore and Madras in the north. These fruits are mainly transported to all the markets except Madras by a motor lorry kept for the purpose. The best fruits at his depot at Pattiveerampatty are sold at 0—6—0 each. Such fruits are generally purchased by European Officers of this District. The medium size fruits are sold at 3 to 4 annas each. The lower grade are sold at 1 to 2 annas each,

Income. From the pine apple estate of 10 acres, the planter gets a gross income of Rs. 1000 per year, but his total charges for this estate including three hoeings removing suckers, and earthing up the plants, come to Rs. 300 per year. In addition cooly and supervision charge come to Rs. 400 per year. Thus he realises in normal years a net income of Rs. 300 per acre.

It seems that the planter has obtained a net income of even Rs. 400 per acre for nearly 12 years even when the damage by wild pigs was at its minimum. It was only then he advertised about the high qualities and delicious taste of the fruits in all the markets in the south. Recently the demand for the fruits has not been so keen as it was once before.

Wild pigs are regular enemies for this crop, The smell of these fruits attract a number of them during nights. Wild pigs not only damage the fruits but also uproot the plants to eat away the worms which are commonly found in the soil.

Notes & Comments.

Agricultural Meteorology. An important aspect of agricultural research which has recently attracted the attention of many works all over the world is Agricultural Meteorology. Very little attention appears to have been paid till now, at least in this country, to the study and the investigations on the various influences exerted by variations in the several weather factors like rainfall, temperature, humidity etc. on crop growth, crop returns, incidence of deseases and pests and the economic result in general. Workers in different aspects of agriculture are now beginning to realise, that changes in weather, in different areas, have a corresponding beneficial or evil effect on the crops, and studies on the ecology of plants and animals are now made in close relation to seasonal and whether changes. Forecasting of weather conditions even for such a short period as a week would be found very helpful to the agriculturist in some tracts. We would invite the attention of those interested in this subject to the three volumes of Bibliography on Agricultural Meteorology recently issued by the Ministry of Agriculture and Fisheries. Recently we also had a very interesting talk on this subject at the Agricultural College by Dr. L. A. Ramadass stationed in Poona as the Agricultural Meteorologist working under the Imperial Council of Agricultural Research.

Research on Pure and applied Sciences. Among certain Institutions and administrators there is at present a tendency to discourage all scientific research which does not show any immediate relation to any practical needs of man, in fact an aversion for all pure or fundamental economy. It may be noted, as is well pointed in the leading article in Nature, of July 15th, that pure scientific research is not merely the gratification of intellectural curiosity but indeed an essential step in an economic process which results in applications to the practical issues of the day. What is wanted however, is, as beautifully explained in the article referred to, a judicious blending of both, and thorough co-ordination between workers in both lines. There should also be dominant in the minds of those who pursue the vocation of science, whether pure or applied, a spirit of service, and on the part of the public a generous recognition of that spirit in science and her followers.

The United States Department of Agriculture. It may be gathered from the following facts that economy cuts are in vogue in other countries and that the problem of unemployment is very much to the front.

It is reported that the personnel of the department of Agriculture in the U. S. A. and the funds for extension services, land grant colleges, vocational education, and experiment stations, have been considerably reduced by a 25% cut all through. More than a thousand persons have, it appears, been separated from the different bureaus of the agricultural department since March last and where vacancies had occured due to deaths or resignations, the places have been left unfilled. It is estimated that during the past year the total number of abolitions, dismissals and reductions in that one department amounted to over four thousand.

The Sugar Committee Meeting at Coimbatore. A meeting of the special committee by the Imperial Council of Agricultural Research, Delhi, to consider the future development of the Sugar Industry of India in its various aspects has been arranged to take place at the Imperial Sugarcane Station, at Chettipalayam near the Agricultural College, Coimbatore, during the middle of November. It is understood that very important schemes are to be discussed in connection with this important industry, and there is no doubt that all members of the Committee will always have the welfare of the Indian cane grower first and foremost in all their deliberations. We await with interest the results of the meeting.

ABSTRACTS

Weeds and their control. (*Department of Agri. in collaboration with the Univer. of Brit. Columbia Bull. No. 106*). The subject has been treated in a popular language without the use of many Scientific terms. Although the publication presents information only about British Columbia, the introductory portion contains much useful information on (1) the organisation required to check spread of weeds, (2) the estimated losses from weeds (3) how weeds spread (4) how some of them are noxious (5) the classification of weeds (6) the general methods of control and (7) the use of weed chemicals

Among the lines of assistance rendered by the Government in the matter of educating the farmers in overcoming this menace are (a) crop competitions and their value (b) seed fairs (c) propaganda through literature and (d) loaning of seed cleaning machinery.

The general methods of control include short rotations, use of high grade seed, grinding feed, ensilage, proper preservation of manure and the best time for weeding. The different cultural practices that are likely to keep down weeds are detailed under the annuals, biennials, winter annuals and perennials. Sodium chlorate at the rate of one or two pounds in a gallon of water for 100 sq. ft. of weeds, is advocated for perennials. Copper sulphate (3% solution) at the rate of 75 gallons per acre when the grain crop is about 9″ high, or sulphuric acid (3½% solution by volume) at the rate of 100 gallons per acre at the same stage is found effective on annuals like wild mustard (*Brassica arvensis.* L.) in British Columbia.

R. B.

Carotin. *The principal natural yellow pigment of milk fat—Part II* (*Agrl. Exp. Stn. Missouri. Res. Bull 10*). Methods of identifying the two pigments carotin and xanthophylls in butter fat and plants, and their spectroscopic properties are described. All breeds of cows produce highly coloured milk fat for a short time after parturition, and the pigments are identical with the normal pigments of the fat. Such an increase is probably due to the different physiological conditions for milk secretion. The degree of colour production is to a certain extent dependent upon the kind of breed of the cows. The colour of cow's milk fat is due to the pigments carotin and xanthophylls which are usually associated with chlorophyll of all green plants. These two pigments are merely taken up by the cows from the greenfeed, and secreted in the milk When the supply through food is reduced or stopped, the butter fat becomes gradually colourless; the depletion of this colour is dependent upon the supply of the pigments, the length of time during which the supply is cut off, and the amount of milk fat secreted.

R. B.

The Digestibility of artificially dried grass, (*Vermont Agrl. Exp Stn. Bull. 348*). The object of the experiment is to find how far the concentrates may be replaced by the artificially dried grass, in the feeding of cows. Two sets of digestion trials are compared (1) green grass versus dried grass (2) dried grass versus grain in the entire ration composed of other roughages. The conclusions arrived at are (a) that in the matter of digestibility, both green and dried grass are equal, (b) that on the basis of dry matter both contain about the same digestible total nutrient matter, (c) that the digestibility of the various nutrients in dry grass and grain are different especially in crude fibre and ether extract and (d) that there is no difference in the mineral balances of calcium and phosphorous. R. B.

Potash on Potatoes. (*Tasmanian Journal of Agriculture Extension service staff*). Two replicated manurial trials were carried out with medium Brownwell potatoes, the plots being in randomised blocks with four replications. The treatments were, no potash, 2 cwts, 4 cwts, 6 cwts and 10 cwts potash sulphate. The results showed that potash had little effect except when applied very heavily and then it reduced the yield A small increase occurred in the case of 2 cwt. plot, but this was of doubtful significance.

Experiments on the comparative effects of sulphate and muriates of potash, showed that sulphate gave a greater increase in yield than muriates, but there seems to be no agreement in the two manures as to the best time to apply potash. There is a possibility that the effect of the dressings may extend over one season.

M. R. B.

Gleanings.

Twenty Tons of Sugar Per Acre. *Remarkable results in Queensland.* In the season of 1931-32 Brake, at the south Johnstone Station in Australia, carried out with sugarcane, an experiment such as the International Institute has recommended be made, with sugar beets in as many regions as possible. Sugarcane of the Badila variety was planted on a deeply ploughed field, which was well fertilised and the soil kept at the optimum water content throughout the growing season. The crop was harvested at the end of 16 months and yielded 143·9 long tons of mill cane per acre (3612 metric quintals per hectare) containing 15·9 per cent of sucrose. corresponding to a yield of 22·8 long tons of commercial canesugar (94 per cent per acre, or 57·3 metric tons per hectare. The present average yield of sugar in Queensland, at best does not exceed 3 tons from unirrigated fields. (Facts from Sugar, June 1933.)

An effective formula for Poisoning Green Timber. An effective way for rapidly killing green timber and at the same time reducing suckering to a minimum is to frill the tree and poison it by pouring into the frilling a solution of sodium arsenite. The best time to carry out the operation is when the sap flow in the tree is ceasing, a period which varies in different districts. but as a rule commences about February.

A useful formula for quick and effective work in all kinds of timber is, arsenic 1 lb, washing soda 1 lb, or caustic soda ½ lb, water 3 gallons. Arsenic—the ordinary white arsenious oxide of commerce—is not soluble in water to any great extent, so that, soda, either the ordinary washing soda or caustic soda, has to be used to dissolve it. When large amounts of the solution are required, washing soda will be cheaper, but for small quantities of solution caustic soda will possibly be found the handiest.

When preparing the solution, whether caustic soda or washing soda is used, first dissolve the soda in a convenient amount of water, using heat if desirable, to hasten the process then slowly add the arsenic, which has been previously made into a thin paste, stirring all the time; place on a strong fire and after it has come to the boil allow it to remain boiling for at least half an hour, stir from time to time and be careful to stand on the side away from the fumes as they are poisonous and are apt to cause sickness. When the arsenic is thoroughly dissolved, the solution may be made up to the required bulk by adding the remainder of the water, either hot or cold.

Frilling the tree consists of a succession of downward axe cuts completely round the trunk, each cut well overlapping the adjoining ones so as to leave no unsevered section of bark up which the sap can flow. Frilling alone will ultimately kill the timber but the posion does it in a fraction of the time; in fact, trees have been killed in a few days. The cuts must be through the bark and well into the wood proper and as close down to the ground level as is convenient to cut them consistent with the shape of the tree - say, from 6 to 10 inches up. For trees of four feet in diameter, pour about a quart of solution into this frilling right round the tree, using an old tea pot or kettle, as the spout makes pouring easy, and less is wasted by spilling. Smaller trees naturally need less solution. Saplings may be cut off low down, and the solution dabbed on w th a swab stick to kill and prevent suckering.

It is very important that the frilling and the application of the poison be consistent and thoroughly carried out if good results are to be looked for.

There need be no fear of stock being poisoned by using the fallen or dead leaves from poisoned trees, for with the comparatively small quantity of solution used the likelihood of leaves absorbing any free arsenic is very remote;

but there is some danger. to stop grazing on areas frilled and poisoned, and it is desirable to keep all stock off for three or four days when all possible chance of danger would have disappeared.

Although arsenite of soda is obtainable from drug merchants, its use when procured in that form cannot be recommended for the poisoning of green timber, as it is most irregular in its arsenic contents. Prices for arsenic, caustic soda, and washing soda are apt to alter frequently. It is, therefore, advised that when a considerable area is to be treated one or other of the wholesale chemists be written to and quotations obtained.

Arsenic pentoxide may be substituted for arsenic and soda. It is soluble in water, but, as it has corrosive action, wooden or earthenware containers woudl be required.

Although the method described kills the tree much more speedily than frilling alone, the usual drying out must take place before the tree can be burnt. (Queensland Agricultural Journal.)

College News & Notes.

Michaelmas holidays. The College closed for Michaelmas holidays on the 15th September and reopened on the 2nd October. Consequent on the re-organisation of the University examinations by virtue of which there will be a University examination at the end of each year, the College Council has decided to do away with the terminal examinations in September. Consequently, there were no examinations before the recess for Michaelmas.

Games. *Y. M. C. A. Cricket tournament.* Since the first match of the tournament reported in the August issue of the Journal, our College played two more matches. The first was against the Municipal High School on the 26th August. We had first tenancy of the wicket and though we opened disastrously, we were able to put up a huge score of 200 for five wickets and declare. Narasinga Rao played a capital innings scoring 92, but was very unfortunate to miss the coveted century. Thomas followed with a useful 51 (not out). The School was dismissed for a total of 39 runs, Lakshmanan doing the most damage and following on, made 29 runs for 8 wickets. Our next match was against the New Mysore Sports Club. Batting first, the Club scored 122 runs, of which their captain Muthuswami made 36 and Ratnam 26. Lakshmanan was again successful with the ball, capturing 7 wickets for 53 runs, while Narasinga Rao took 3 for 39. Though we in our turn opened confidently, a series of disasters including two run outs and two l. b. w. decisions were in store for us, so that we finished up with a poor total of 90 runs. For the first time this season, our colours were lowered and an unbeaten record was spoiled by an unexpected defeat. Special mention has to be made of the fighting innings played by Albuquerque who scored 27 not out, and of Ramanatha Rao, who, despite the serious injury sustained earlier in the game, contributed a valuable score of 15. Our opponents in this match having won all their matches, the Rhondy Shield goes to them.

Games Tour. The first of our games tours this season came off during the third week of August when we went to Salem and played a series of matches in cricket, football, hockey and tennis. Advantage of the trip was taken to spend a day sight-seeing at Mettur, where the party was kindly shown round the dam works by Mr. Narasinga Kamath, assistant Engineer, who by the way is an old friend of the College having been in charge of the constructions of the Freeman Buildings. Our first game was at Cricket on August 20 against the Salem United Club. Batting first, our opponents made 129 runs. Narasinga Rao excelled himself with the ball taking as many as 8 wickets for 43 runs. We replied with 85 runs for 5 wickets when stumps were drawn. Ramanatha Rao made an unfinished 29. Albuquerque who retired hurt, made 18 and Shiva Rao 13. The same evening we met the Salem College at football and lost to them by 4 goals to 2. On the 21st, we played a cricket match against the Selam College and dismissed them for 70 runs of which the College captain made 40. Lakshmanan did best with the ball capturing 7 wickets for 27 runs. We replied with 85 runs for 5 wickets of which Thomas contributed 37 (retired) Narasinga Rao 16, and B. S. Murti 17 (not out). The same day we played hockey against the London Mission High School and won comfortably scoring 6 goals against 1. Though our best player was unable to accompany the party, a few matches in Tennis were arranged against the best local talents including some well known presidency players but our opponents proved superior to our men.

Football and Hockey. We played a friendly match each in Football and hockey against our sister institution—the Madras Forest College—and lost the former by 1 goal to nil. The Hockey match had to be left unfinished owing to rain when we were having a lead of two goals to one.

Ladies' Club. The Ladies' club building constructed recently was opened on the 8th September, by Mrs. T S. Krishnamoorthy Ayyar, the wife of the District Educational officer. There was a large and distinguished gathering of ladies and gentlemen in the Vadivambal Ammal Hall named after the wife of Rao Bahadur C. Tadulingam, when the guests were treated to music and *Pansupari*. On the 9th, the members of the Club entertained Rao Bahadur and Mrs. Tadulingam at tea in appreciation of the donation made by them and which made the construction of the building possible.

Research Engineer. It is learnt that Mr. N. G. Charley, B. E. till recently our Research Engineer, and who is now on leave in Australia, has been offered and has accepted the post of Research Engineer for another term of 5 years. Mr. Charley is expected to be back in Coimbatore by December.

Foreign Study. Three officers of the Department recently left for Europe for higher study. Mr. T. Murari B. Sc., Superntendent of the Live Stock Research Station, Hosur, is now on a tour of several European countries undergoing further study in animal husbandry. Mr. J. A. Mulyil, B. A. of the Entomology section has proceeded to Great Britain for higher study in Entomology. Mr. C. Narasimhachari, B. A., M. Sc, has left for England for the study of soil Science and it is understood that he will do Research work at Rothamstead Experimental Station at Harpenden. It is learnt that Mr. P. V. Ramiah, Assitant Chemist will also be proceeding to England shortly. The best wishes of their fellow officers go to these gentlemen.

Visitors. Mr. P. V. Isaac, officiating Imperial Entomologist, Pusa, was at Coimbatore for about 20 days during September, studying the *Tabanids* of Coimbatore and the surrounding districts. Mr. R. D. Kapur, Economist to the Imperial Council of Agricultural Research was at Coimbatore on a short visit to study conditions of Agricultural economics and then left for Tennevelly. M. R. Ry. Rao Bahadur M. R. Ramaswamy Sivan, Retired Principal, Mr. M. R. V. Panikkar, Professor of Pathology at the Veterinary College, Madras, Mr. Pinto, Industrial Engineer, and Mr. D. S. Sahasrabudde, Government Agricultural chemist Bombay, attended a meeting of the Board of Examiners at the Agricultural College, on 12th October.

ASSOCIATION OF ECONOMIC BIOLOGISTS.

At an ordinary meeting of the association held on 4th September the following two papers were read and discussed:

Chromosome Numbers in the Genus Saccharum and its Hybrids. by T. S. N. Singh.

The paper which was illustrated with lantern slides, dealt with the chromosome numbers in the genus Saccharum, some of its interspecific and intergeneric hybrids, and four bud-sports that were noticed in the variety Co. 213. The various forms grouped under *S. Spontaneum* were reported to show chromosome numbers varying from 27 to 64 and the bud-sport numbers from 46 to 62, the one with 46 chromosomes being reported as a degenerate type. In the *Saccharum* hybrids, the doubling noted on the mother side by Dr. Bremer, was not noticed in certain of the hybrids with Indian canes. At the end of the paper, a discussion arose mainly on two points, one of which was, whether the author was able to distinguish the two parental genome sets in the hybrids. In this connection, it was pointed out that the study of somatic divisions as in root tips, which alone would throw light on such facts, was not undertaken by the author, owing to the large number of chromosomes in such divisions rendering the study difficult. The other point discussed was about the real nature of the degenerate type. It was suggested that apart from its losing vigour year after year, other conditions in meiosis, which the author had not studied, might reveal its real nature, there being no direct relationship between degeneracy and the smaller number of chromosomes observed in them.

Bees and Beekeeping in S. India. By T.V. Ramakrishna Ayyar anb S. Ramachandran. The paper presented in a very compact form, an account of the honey bees we have in S. India of which there is no previous record and the popular methods practised all over India in artificial beekeeping. The paper also gave a short summary of the attempts that were being made by the Entomology section of the Agricultural Research Institute to demonstrate and popularise the modern methods of beekeeping as is practised in many of the western countries. At the end of the paper, was given a statement of the economics of beekeeping as a cottage industry in S. India, expenses involved and profits to be realised. A number of specially prepared latern slides were shown to illustrate the matter contained in the paper. At the end there was a lively discussion when questions were asked (1) about the importance and status of the wax moth, whether it was a real pest or only a scavenger as has been reported in the west, (2) about the obtaining of bees' wax used by the bee for building its hive without damage to the bee, (3) whether the eggs hatching out into workers were intrinsically different from those hatching out into queens, (4) what causes the bee to swarm and form separate colonies, (5) how does the male bee meet with its end, whether it is actually killed by the queen after the mating or does it die itself as a result of the removal of its coopulatory organs, (6) whether the honey collected by the bees during different seasons tastes differently etc. The authors in briefly replying to the various questions raised stated, that the wax moth was really a serious pest in S. India unlike in the west, that the combs become useless for storing honey after two or three years and might be destroyed to make the wax there from, that under favourable circumstances any worker egg can become a queen egg, that swarming and starting new colonies were essentially physiological intincts with the bees, when the hives become overcrowded, that the death of the male was not due only to the removal of the genital organs but to the removal of the whole entrails along with it, and that there were distinct differences in the taste and aroma of the honey collected in different seasons. With a few general remarks from the president the meeting terminated.

Review

"Agricultural Lessons" in Malayalam by *O. Raman Menon, Headmaster, Agricultural School, Tripunithora, Cochin State, (pp 265, Price Annas twelve).* This is an interesting and readable hand book in the Malayalam language on agricultural matters with special reference to conditions in the West Coast areas. The author has taken pains to systematise the different subjects and has treated the different aspects of agriculture in a clear and lucid manner. He has divided the subject into three main sections, that dealing with the soils including soil physics, agricultural engineering and agricultural chemistry, the second on botany including health and diseases of plants. and the third on the different cultivated crops and the various methods of raising each. This hand book is also supplemented with a few good text figures. There is no doubt that this small book will serve the needs of agricultural schools in the West Coast area. We congratulate the author on the excellent production and the nice get up of the book. (Editor, M. A J.)

Insects of Coconuts in Malaya by *G. H. Corbett—Bulletin No. 10. of the Department of Agriculture, Federated Malaya States.* This is a handy and well illustrated publication which may be found very useful especially to coconut planters in the Asiatic archipelago and to some extent to cultivators of this palm in Ceylon and S India. While it includes some general information on practically all insects noted on coconut in Malaya, special attention is found devoted to what appear to be the more important and well known pests of the palm. In order to make clear some of the inevitable technicalities in the text, the work is prefixed with a general note on insects and is followed by a useful glossary explaining the special technical terms applied in connection with insects. The illustration plates of which there are as many as 19, include two coloured ones which are nicely executed. This feature has considerably added to the value of the work since readers can identify insects much more easily from a good illustration than from lines of text. We congratulate the author on this useful work. (Ed., M. A. J.)

Rice crop in Burma by *J. W. Grant, M.A., B.Sc., I. A. S. (Agricultural Department, Burma Agricultural Survey No. 17 of 1932. Price Rs. 3-8-0=Sh. 5. d 3.,* Rice is the most important crop in Burma covering about 75% of the cultivated area and it is on the rice crop that the prosperity of that country depends, as 75% of the population are engaged in rice cultivation and trade. The book gives a lucid account of the history, cultivation, marketing and improvement of rice in Burma. The main feature of the history of paddy cultivation in Burma is, that most of the area now occupied by rice has been brou ht under cultivation during the last 60 years by small cultivators producing for export market, the work having been financed by Madras Chettiars. Rice area is about 12½ million acres, and the production is about 7 million tons of rice, of which nearly 45% finds its way into the foreign export trade, due to the low density of population. Orginally before the war, Burma rice was occupying a predominant position in the European market as more than 40% of the exportable surplus found its way there. After the war, this export gradually declined less than 20%. due to the competition from higher grades of rices that have been produced by Spain, Italy and America. At the present time, India and Ceylon occupy an important position in the trade relations with Burma, as they consume more than 50% of the exportable surplus of Burma rice.

Most of the rice area in Burma is rainfed and the method of cultivation and rice growing is not in any way in advance compared with India, though the size of the average holding is considerably more in Burma being about 20 to 25 acres. Little or no manure is supplied and it can be said that the soils have reached the basic minimum fertility with continuous cropping for many years, without adequate plant food not being returned to the soil. With the present prices of paddy, considerations of application of artificial fertilisers are out of question. Green manure crops are not in favour due to the conditions of soil after the harvest of paddy. The average yield is only about 1500 lb per acre and the cost of cultivation is about 15 rupees per acre and the net return is about 12 to 14 rupees per acre. Hence the importance of Burma's place in the international market is wholly due to the large exportable surplus which in turn is due to her sparseness of population. The organisation of marketing is mainly in the hands of big millers and middle-men who purchase the produce on the threshing floor.

As most of the rice is for export trade, improvement of the crop is directed towards the elimination of red rice aud aims at uniformity, quality, and yield, in the selection of strains. The Department of Agriculture, Burma, have five research rice stations in the central tracts, where problems relating to rice improvement and selection of strains are tackled. In addition to these, there are about 122 seed farms established at convenient centres throughout the districts, for multiplication and distribution of improved seeds to the cultivators. Of these seed farms, 15 are equipped with buildings and storage facilities and in the rest, 107 in number, storage facilities are provided for, by the tenants who work on the land.— *N. P.*

Crop and Trade Reports.

Crop 1933-34 Gingelly First Report. The average of the areas under gingelly in the Madras Presidency during the five years ending 1931-32, has represented 12·3 per cent of the total area under gingelly in India.

2. *Area.*—The area under gingelly up to the 25th July 1933 is estimated at 395,700 acres ; compared with the area of 388,800 acres estimated for the corresponding period of last year, there has been an increase of about 2 per cent Almost all the important districts except Anantapur, Chingleput and North Arcot have contributed to this increase, while these three excepted districts show a considerable decrease

3. *Yield.*—The yield is expected to be normal except in the districts of Chingleput, South Arcot, Chittoor, North Arcot and Salem, where the crop was partly affected by drought.

4. Details by districts are given below :—

Area in hundreds of acres, i e., 00 being omitted.

District and Group.	Estimate of the area sown up to the end of		Increase (+) or decrease (−) of the area in column (3) as compred with the area in column (2).
	July 1932.	July 1933.	
(1)	(2)	(3)	(4)
	Acs.	Acs.	Acs.
Ganjam	25,0	29,0	+4,0
Vizagapatam	90,0	94,0	+4.0
East Godavari	47,0	48,0	+1,0
West Godavari	42,5	48,0	+5,5
Kistna	4,7	6,2	+1,5
Guntur	4	4	Nil
Total, Circars ...	209,6	225,6	+16,0

Kurnool	7	5	— 2
Bellary	4,8	2,9	— 2,8
Anantapur	12,0	5,3	— 6,7
Cuddapah	3	1	— 2
Total, Deccan ...	17,8	7,9	— 9,9
Nellore	8	3	— 5
Chingleput	24,5	11,0	—13.5
South Arcot	10,0	11,5	+ 1,5
Total, Carnatic ...	35,3	22,8	—12,5
Chittoor	3,5	3,6	+ 1
North Arcot	28,0	19,0	— 9.0
Salem	46,0	47,0	+ 1,0
Coimbatore	23,0	24,5	+ 1,5
Trichinopoly	3,6	4,0	+ 4
Total Central ...	104,1	98,1	— 6,0
Tanjore	1,8	7	— 1,1
Madura	8,0	10,5	+ 2,5
Ramnad	2,0	7,5	+ 5,5
Tinnevelly	9,2	21,5	+12,3
Total, South ...	21.0	40,2	+19,2
Malabar	1	2	+ 1
South Kanara	9	9	Nil
Total, West Coast ...	1,0	1,1	+ 1
Grant total ...	388,8	395,7	+ 6,9

Pepper Crop, Madras 1933-35—**First Report Area.**—The area under pepper up to the 25th August 1933, in the districts of Malabar and South Kanara is estimated at 95,000 Acs. (87,000 acres in Malabar and 8,000 acres in South Kanara) against 87,300 acres (80,000 acres in Malabar and 7,300 acres in South Kanara) as estimated on the corresponding date of last year.

2. **Condition.**—The setting in of the South-West monsoon early in the middle of May and the heavy rainfall afterwards were not favourable for the full flushing and flowering of pepper.

3. **Price.**—The whole-sale price of pepper at important markets on the West coast towards the close of August 1933 was about Rs. 19—10—0 per imperial maund of 82 and 2/7 lb.

Ginger Crop - Madras 1933-34—**First Report.** The area under ginger up to the 25th August 1933 in Malabar is estimated at 10 000 acres as in last year. The crop has been affected by root-rot disease in the Ernad taluk. The condition of the crop is fair in the other taluks.

2. The wholesale price of dry ginger at Calicut towards the close of August was Rs. 7—2—0 per imperial maund of 82 and 2/7 lb.

Cotton Crop—Madras -1933-34—**Second Report.** The average of the areas under cotton in the Madras Presidency during the five years ending 1931—32 has represented 9 per cent of the total area under cotton in India.

2. The area under cotton up to the 25th September 1933, is estimated at 740,400 acres. When compared with the area of 822,300 acres estimated for the corresponding period of last year, it reveals a decrease of about ten per cent. The decrease is general and may be attributed to the fall in prices for cotton.

3. The area in the South and the Central districts relates partly to the last year's crop and partly to the current year's sowings which have just begun in parts.

4. The area in the districts of Bellary and Anantapur has fallen from 390,000 acres to 354,000 acres as sowings were held up by continuous downpours of rains.

5. The condition of the *mungari* or early sown crop in parts of the Deccan is satisfactory.

6. The wholesale price of cotton lint per imperial maund of 82 and 2/7 lb. as reported from important markets towards the close of September 1933 was about Rs 15—10—0 for Cocanadas, Rs. 14—0—0 for red northerns, Rs. 14—12—0 for white northerns, Rs. 13—9—0 for (early crop) westerns, Rs. 23—9—0 for cambodia, Rs. 22—2—0 for Coimbatore Karunganni, Rs. 20—11—0 for Tinnevelly Karunganni and Rs. 19—6—0 for nadam.

Sugarcane crop—Madras—1933-34—intermediate Report. The condition of the sugarcane crop is stisfactory owing to the good rains in August. Normal yield can be expected if the present conditions continue.

2. **Price.** The wholesale price of jaggery for imperial maund of 82 and 2/7 lb. towards the close of August was Rs 5—2—0 in Erode (Coimbatore). It ranged from Rs. 3—5—0 to 3—8—0 in Vizagapatam, Vellore (North Arcot) and Trichinopoly and Rs. 4—2—0 to 4—11—0 in the other important districts. As compared with the prices reported for July 1933, there was a fall of 15 per cent in Erode and 12½ per cent in Trichinopoly The variations in the other districts are small.

Weather Review (SEPTEMBER—1933)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	9·8	+2·5	36 5
	Berhampore *	1 ·6	+2·3	45·9
	Calingapatam	7·9	+0 3	34·1
	Vizagapatam	5·5	-0·9	16 6
	Anakapalli *	11 0	+4·8	35·3
	Samalkota *	8·5	+2·3	24 8
	Cocanada	7·6	-2·2	22·8
	Maruteru *	6·3	+0·2	30·4
	Masulipatam	4·9	+1·2	27·5
	Guntur *	1 8	-5·1	21·1
Ceded Dists.	Kurnool	4·6	-1·4	18 6
	Nandyal *	3 5	-3·2	25·6
	Hagari *	5·9	+3 5	21·8
	Bellary	7·7	+1·1	29·3
	Cuddapah	2·5	-3·6	17·0
	Anantapur	0·7	...	21·6
Carnatic	Nellore	2 1	-2·6	17 4
	Madras	1 2	-3·6	9 0
	Palakuppam *	3·9	-0·1	19 9
	Palur *	1·4	-3·6	26·6
	Cuddalore	1·6	-4·6	22·2
Central	Vellore	1·3	-5·7	14·6
	Salem	7·1	+0·7	29·3
	Coimbatore	6·0	+2·8	16·6
	Coimbatore Res. Inst. *	5·0	+3·0	17·2
	Trichinopoly	3·0	+1·6	18·8

Division	Station	Actual for month	Departure from normal	Total since January 1st
South	Negapatam	2·7	-1·0	15·3
	Aduthurai *	2·8	-0 3	13·6
	Madura	1·4	+3·6	22·7
	Pamban	1·0	+0·8	6·9
	Koilpatti *	1·5	-0·6	10·7
	Palamkottah	1·1	+0·1	15·1
West Coast	Trivandrum	9·2	+4·4	97·7
	Cochin	14·5	+4·2	137·6
	Pattambi *	13 8	+5·3	121·9
	Calicut	15·7	+7·6	149·8
	Taliparamba *	21·5	+10·8	171·8
	Kasargode *	11·9	+3·0	150·5
	Nileshwar *	11·9	+0·1	153·6
	Mangalore	14·6	+4 5	144·9
Mysore and Coorg	Chitaldrug	7·6	+2·2	27·1
	Bangalore	4·1	+3·6	30·8
	Mysore	2·7	+2·7	30·2
	Mercara	24·4	+13·6	148·3
Hills.	Kodaikanal	9·2	+0·9	51·7
	Coonoor *			
	Kallar *	6·1	+2·5	38·7
	Ootacamund *	5·9	+1·4	48·1
	Nanjanad *	6·2	+1·4	45·1
Central	Hosur cattle farm *	4·1	+3·5	20·5

* Stations of the Agricultural Dept.

Summary of general weather conditions: The widespread thunderstorms which prevailed in the last week of August continued to be active till the 5th causing rain in South Madras, Mysore and Deccan. Then the conditions became unsettled in the central Bay of Bengal which developed into a depression on the 7th off the Circars coast moving northwestwards and was centred about 75 miles south east of Calingapatam. It crossed the coast near Calingapatam on the 10th into the interior and weakened considerably by 12th resulting in local heavy falls Another Bay depression formed off the Orissa coast on 12th passing into the inland strengtheing the monsoon in East Rajaputana, Gujarat which later on weakened with heavy showers in Agra and Delhi. Simultaneously with the formation of a depression in the Bay, a shallow formed off the Konkan-Kathiawar coast, moving northwestwards and weakened causing an extension of the monsoon in Lower Sind. About the middle of the month a low pressure wave passed from the east into the Bay across Burma, moving westwards into the Bay and concentrated into a deprossion off the South Arakan coast. Consequent upon the intensification of the depression, a cyclonic storm was experienced at the head of the Bay on the 20th south east of Saugor island crossing into the interior as a deep depression over Chota Nagpur causing strong monsoon and heavy rains in Lower Burma, Pegu and Tennasserim. This gradually moved farther into the interior north westwards into Central Provinces and Central India and weakened itself with heavy showers in the Punjab and Kumaon hills on the 24th. Later on pressure distribution changed over to one of normal for the time of the year at the end of the month and conditions became favourable for the incidence of thunderstorms over the south. The monsoon showers weakened and withdrew from the country from about the 27th, with widespread thunderstorms throughout the Presidency.

The humidity was in excess in North Madras and Circars in the early half of the month and in defect in places elsewhere. For the major part of the month maximum temperature was below normal except in Nellore which recorded a maximum of 101° F about the 15th. The tendency was more towards returning to normal throughout the rest of the month.

Rainfall was in excess in parts of Circars, Ceded districts, the West Coast Mysore Plateau and South Madras.

The chief amounts recorded were Kodala (Ganjam) 5·9" (13th), Hagari 2·8" (3rd) Chitaldrug (Mysore) 3·5" (4th) and Mangalore 2·7" (7th).

Weather Report for the Research Institute Observatory: Report No 9/33.

Absolute maximum in shade	95·5°
Absolute minimum in shade	66·0°
Mean maximum in shade	87·2°
Mean minimum in shade	70·7°
Total rainfall	4·98"
Departure from normal	+ 3·00"
No. of rainy days	7
Heaviest fall in 24 hrs.	1·92"
Mean daily wind velocity	5·5 M.P.H.
Mean humidity at 8 hrs.	77·7%
Total hours of bright sunshine	202·7 hrs.
Mean daily hours of bright sunshine	6·3 hrs.

Summary of weather conditions: The pressure was steady throughout the month with slight fluctuations during the last week causing some showers. The rainfall was above normal but the temperature was generally above the average.

The weather was marked with local thunderstorms indicating a transition to the north east monsoon type of weather. The days were hot and nights sultry during the month.

C. V. R. and T. S. L.

Departmental Notifications.

First Circle. M. Ramamurthy, A. D. Palakonda, l. a. p. for two months from 24-10-1933; S. Ramaswami Ayyar, Botany Assistant, Anakapalle, l. a. p. for 15 days from 20-9-33. **Second Circle.** M. P. Narasimha Rao, A. D. Kaikalur, l. a. p. for 1 month and 20 days from 12th September 1933. **Third Circle.** P. Subrahmaniam, A. D. Gooty, l. a. p. on m. c. for one month from 25-9-1933 **Fourth Circle.** K. Varadachari, F. M. Palur extension of l. a. p for 10 days from 7—10—33; M. N. Rangaswami Ayyangar, A. A. D. Trivellore, transferred as A. F. M. Kalahasti. **Fifth Circle.** T. R. Venkaswami Rao, A D. Tiruvalur, l. a. p for two months from 6—10—1933. **Sixth Circle.** G. Venkatakrishnan, on van duty, to relieve C S. Sankaranarayanan, A. D. Tirumangalam, posted to Tinnevelly; A. M. Muthayya Nattar, A. D. Dindigal, extension of l. a p. for 10 days from 13—3—33. V. Ayyaswami Ayyar, A. A. D. Tenkasi, l. a. p. for 15 days; S. Bhimaraju, A. A. D. Sivakasi l. a. p. for two months from 6—10—33. **Principal's Section.** L. Narasimhachariar F. M. Central Farm l a. p. for 12 days from 9—10—1933; A. H. Subrahmania Sarma l. a. p. for 21 days from 14—9—1933. **Paddy Specialist's Section** R. Subbayya Gounder, Sub-Asst. l. a. p. for one week from 25—9—1933. **Millets Section.** P. V. Hariharan, Assistant, l. a. p. on M. C. for a month and a half from 25—8—1933; **Cotton Section.** P Abraham Asst. l. a. p. for 16 days from 22—9—1933. V. Marghabandu, Asst. l. a. p. for 11 days from 20—9—1933. **O. S. S's Section.** A. P. Balakrishnan Nair, F. M. Pilicode l. a. p. for 25 days from 11—9—1933. **D. A's Office, Madras.** L. Krishnan, Upper Subordinate, offg. to continue to officiate from 17—9—33 to 6—11—33, vice T. S. Venkatarama Ayyar A. D. on leave. T. K. Mukundan, Upper Subordinate, offg. to continue to officiate from 6—10—33 until further orders vice A. Gopalakrishna Ayya on other duty. **D. A's Office Orders** The following officiating appointments in the Madras Agricultural subordinate service - Class I Upper subordinates III grade in the scale of Rs. 75-7½/2-105 are ordered with effect from 20th October 1933. (i) M. R. Ry. N. G. Narayanan, B. c. Ag., to officiate as Assistant in the cotton section at Coimbatore *Vice* M. R. Ry. K. L. Ramakrishna Rao on other duty or until further orders - to report himself for duty to the Cotton Specialist, Coimbatore. (ii) M. R. Ry. C. K. Ramachandran, B. Sc. Ag, to officiate as Assistant in the cotton section *Vice* M R. Ry. S. N. Venkataraman on leave or until further orders—to report himself for duty to the Cotton Specialist, Coimbatore. (iii) M. R. Ry. M L. Balasundaram B. Sc. Ag., to officiate as Assistant in the Paddy section at the Agricultural Research Station Maruteru *Vice* M. R. Ry. C. V. Saravayya Chetti on leave or until further orders - to report himself for duty to the Superintendent, Agricultural Research Station, Maruteru.

ADDITIONS TO THE LIBRARY DURING JULY 1933.

A. Books.

1. The New Agriculture. *O. M. Kile* (1932). 2. The Farm and the Nation. *E. J Russell* (1933). 3. An Introduction to Tropical Soils (tr. by H. Greene). *P. Vageler* (1933). 4 Recent Development in Market Gardening. *Rothamsted Conference No. 15* (1932). 5. Satsuma Orange (a monograph). 6. Orchard Nursery Book: Budding and Grafting (New South Wales Farmers' Bulletin No. 63). *T. Tanaka* (1932). 7. Orchard and Small Fruit Culture. 8. The Dairy Manual (New South Wales—Agri. Dept. Pubn) *E. C. Auchter and H. B. Knapp* (1932) (1933). 9 Animal Industry in the British Empire. *A. N. Duckham* (1932). 10. The Scent of Flowers and Leaves: its purpose and relation to Man. *F. A. Hampton* (1925). 11. Methods in Plant Histology. 5th Edn. Revd *C. J. Chamberlain* (1932). 12. The Human Eye and its inheritance (in German). Bibliographia Genetica—Vol. VII.

P. J. Waardenburg (1932). 13. The Genetics of Gossypium-Bibliographia Genetica—Vol IX *S. C. Harland* (1932). 14. The Commercial Timbers of India (in 2 Vols.) *R. S. Pearson and H B. Brown* (1932). 15. A Bibliographical List of the Entire Domain of Agricultural Chemistry. 1. Soil Science. 16. 2. Soil Analysis. *H. Niklas and Others* (1931). 17. The Structure and Composition of Foods—Vol. 1—Cereals, Starch, Oil Seeds, Nuts, Oils and Forage Plants. *A L. Winton and K. B. Winton* (1932) 18. Applied X-Rays—2nd Edn *G. L Clark* (1932). 19 Laboratory Methods of Organic Chemistry—Revd. by H. M. Wieland; tr. by W. Mecartney from 22nd German Edn. *L. Gattermann* (1932). 20 On the Fixation of Atmospheric Nitrogen by Bacteria Living Symbiotically in Root Nodules of Casuarina Equisitifolia. (Oxford Forestry Memoirs No. 14). *R. N Aldrich—Blake* (1932). 21. Principles of Fruit Preservation. *T. N. Morris* (1933). 22 Phytochemistry. *E. Kremers &c.* (1932). 23. Pigments of Flowering Plants. *N. A. Wakeman* (1913). 24. Vitamins: A Survey of Present Knowledge. *Eng H. M. S Pub.* (1932). 25. A Critical and Historical Study of the Pectic Substances of Plants. 26. Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists—3rd Edn. *M. H. Branfoot* (1933) (1930). 27. Principles and Practice of Agricultural Analysis: A Manual for the Study of Soils, Fertilizers and Agricultural Products—3rd Edn. Revd. and Enlarged:— Vol. I—Soils. *H. W. Wiley* (19 6). Vol II—Fertilizers and Insecticides. *A. O. A C* (1931). 28. The Submerged Weir as a Measuring Device. *G. N. Cox.* (1928). 29. The Diaphragm Method for the Measurement of Water in open Channels of Uniform Cross Section. *C. R. Weidner* (1914). 30. Modern Farm Buildings. *D. N. Mc. Hardy* (1932). 31. The Beginner in Beeculture—3rd Edn. *W. A. Goodacre* (1931). 32 Better Life in the Village—(U. P. Govt. Pub.) *S. S Nehru (Compiler)* (1933). 33. The Indian and the English Village. *F. L. Brayne* (1933). 34. Town and Country Side: Some aspects of Urban and Rural Developments. *T Sharp* (1932). 35. The Economic Consequences of Power Production: 2nd Imp. *F. Henderson* (1932). 36. World Economic Survey—1931-32. *League of Nations Pub.* (1932). 37. Retailing and the Public. *L. E. Neal* (1933) 38. Inland Transport Costs. *F. P Antia* (1932). 39 The Co-operative Movement in India. *E. M. Hough* (1932). 40. Monthly Rainfall of India for 1930. (1932). 41. Indian Year Book, 1933-1934. (1933).

B. Reports.

1. Report of the Food Investigation Board for the year 1931. 2. Annual Report (Twentieth Year) 1932: East Malling Research Station, East Malling, Kent—1st January 1932 to 31st December, 1932. 3 Transactions of the Highland and Agricultural Society of Scotland—Fifth Series—Vol. XLV—1933. 4. Annual Report—Tanganyika Territory—Department of Agriculture—1932. 5. Annual Report of the Statistics Branch—1932 of the Dept. of Agriculture. Part I—Agricultural Statistics. Part II—Chattel Mortgages. 6. Sixth Annual Report of the Council for Scientific and Industrial Research for the year ended 30th June 1932: The Parliament of the Commonwealth of Australia. 7. Official Year Book No. 25, *1932.* Commonwealth of Australia. 8. Ffty-fifth Report of the Connecticut Agricultural Experiment Station, New Haven for the year 1931. 9. Work and Progress of the Idaho Agricultural Experiment Station for the year ending December 31, 1931. (Bulletin 192 of Idaho Agri. Expt. Stn.) 10. Annual Report of Massachusetts Agri. Expt. Station for the year ending November 30, 1932. Bull. No 293. 11. The Teachers' College, Saidapet. Calendar for 1933-34.

C. Bulletins, Memoirs &c.

12. Orpiment in Shellac. *Ind. Lac. Res. Inst. Bull. 13.* 13. Interim Report on Work under Project No. 2. Strength Tests of Timbers in Structural Sizes with test Results up to 1932. *Ind Forest Records, Economy Series, Timber Testing, Vol. XVII, Part VII.* 14. Immature Stages of India Coleoptera (12) (Carabidae

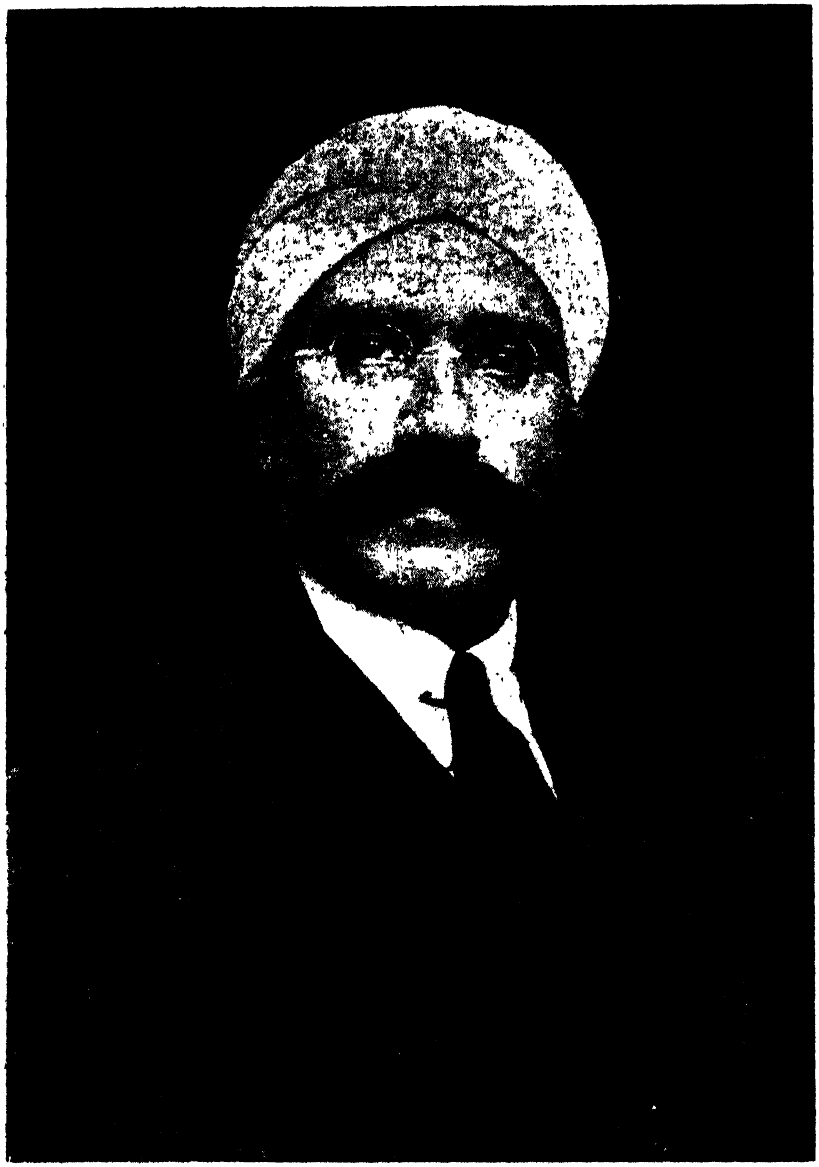
Contd.) *Ind. Forest Record, Entomology Ser. Vol. XVII/XVIII.* 15. Studies on Sub-Soil Hydraulics. Investigation of Observational Methods for Models. *Punjab Irr. Res. Inst. Res. Pub. Vol. 2. No. 2.* 16. Sisal: A Note on the Attributes of the Fibre and their Industrial Significance. *E. M. B. 64.* 17. Fruit Supplies in 1932 (Including vegetables, Flowers and Bulbs). *E. M. B. 65.* 18. Dairy Produce Supplies in 1932. (Including Poultry and Pig Products). *E. M. B. 66.* 19. Domestic Preservation of Fruit and Vegetables. 20. Narcissus Culture. 21. Commercial Bulb Production. *Eng. Mini. Agri. & Fish. Bull. Nos. 21, 44, 62* 22. The Nutritive Properties of Milk in Relation to Pasteurisation. *Hannah Dairy Res. Inst. Bull. No. 5.* 23, Plant Breeding in New South Wales. Fifth Year of Progress, 1930-31. *New S. Wales. Agri Dep. Sci. Bul. No. 39.* 24. A Soil Survey of the Nyah, Tresco, Tresco West. Kangaroo Lake (Vic.) and Goodnight (N. S. W.) Settlements. *Australia Coun for Sci. & Ind. Res Bull. No. 73.* 25. Vegetable Growing in the Coast area of British Columbia. 26 Cooling Milk on the Farm. *Canada Dept. of Agri. Bull. Nos. 164, 165 New Ser.* 27. Farm Fencing. *Alabama Polytech. Inst, Ext. Ser. Cir. 136.* 28. A Preliminary Note on the Physiological and Genetic Aspects of Hair Properties in Egyptian Cottons. *Egypt. Mini, of Agri. Tech. & Sci. Service Bull. No. 123.* 29. Cold Chlorosis of Sugarcane. 30. Sugarcane Root Disease in Cuba Zonate Foot Rot of Sugarcane. 31. The Sugar Industry of Peru. 32. The Tucuman Agricultural Experiment Station in its Relation to the Argentine Sugar Industry. 33. A Preliminary Report on a Grass-Root Mealybug affecting Sugarcane in Cuba. 34. The Cotton Industry of Peru. 35. Three Halminthosporium Diseases of Sugarcane. 36. Parasites of Sugarcane Moth Borers. 37. Pokkah-Bong and Twisted Top Disease of Sugarcane in Cuba. 38. Natural Enemies of the Sugarcane Moth Stalkborer in Cuba. Nematodes Parasitic on Diatreaea saccharalis Fabricius in Cuba Fungi Attacking Diatraea saccharalis Fabricius in Cuba. 39. Target Blotch of Sugarcane. *Cuba Trop. Plant Res. Found. Sci Cont. Nos. 3. 4, 5, 6, 7, 8, 9, 12, 13, 14, 15, 16, 17 & 18.* 40. Preliminary Report on a Study of the Biology of Lixophaga diatraeae (Tns.) 41. The Utilization of Varieties in the Field Control of Sugarcane Mosaic and Root Diseases in Cuba, (A Preliminary Report). *Trop. Plant. Res. Found. Sci. Cont. Nos. 19 & 20.* 42. The Sugarcane Moth Stalkborer. 43. A List of the Insects Affecting Sugarcane in Cuba. 44. Some Serious Sugarcane Diseases not known to Occur in Cuba. 45. Certain Grass Hosts of the Sugarcane Mosaic Diseases and of the Corn Aphid Considered in Relation to their Occurrence in Cuba. 46. Field Control of Sugarcane Root Disease Conditions. 47. Corn Stripe Disease in Cuba not Identical with Sugarcane Mosaic. 48 The Behaviour of the New Poj Canes in Relation to Sugarcane Mosaic in Cuba. 49. Soil Insects Attacking Sugarcane in Cuba. *Trop. Plant Res. Found. Bull. Nos. 2, 3, 4. 5, 6, 7, 9 & 10.* 50. The Development of Package-Bee Colonies. 51. An Economic Study of the Pecan Industry. 52. Distinctive Effects of the Deficiency of Certain Essential Elements on the Growth of Tobacco Plants in Solution Cultures. 53. Causes of Brashness in Wood. 54. The Effect of Concentration on the Toxicity of Chemicals to Living Organisms. 55. An Economic Study of Broomcorn Production. 56. Use of the Exponential Yield Curve in Fertilizer Experiments 57. Analysis of the Advanced Registry Records of 611 Daughters of 51 Ayrshire Sires. 58. Sudan Grass as Hay, Silage, and Pasture for Dairy Cattle. 59, Farmers' Response to Price in Hog Production and Marketing. 60. Bacterial Wilt of Corn. *U. S. A. Agri. Dept. Tech Bull Nos 309, 324, 340. 342, 346, 347, 348, 349, 352, 359 & 362.* 61. Roses for the Home. 62. Farm Sheep Raising for Beginners. 63. The Larger Corn Stalk-Borer. 64. Marketting Eggs. 65. Deciduous—Fruit Improvement through Tree-Performance Records. 66. Corncribs for the Corn Belt. *U. S A. Farmers' Bull. Nos. 750, 840, 1025, 1378, 1696 & 1701.* 67. Commercial Feeding Stuffs. 68. Fertilizer Experiments with Cotton. 69. Creep-feeding Range Calves. 70. Alfalfa Production under Irrigation in Western Texas. 71. Sorghum Silage as a Source of Vitamin A for Dairy Cows *Texas Bull. Nos. 467, 469, 470, 472, 474.* 72. Studies on the Chemistry of Grape Juice. 73. Chromosome Number in the Genus Cucurbita. 74 Lysimeter Investigations: II—Composition of Rainwater at Geneva, N. Y. for a 10-year Period. 75 Percentage of Hardshell in Pea and Bean Varieties. *New York A E S Tech. Bull. Nos. 181, 186, 193 & 195.* 76. Legume Inoculant Tests in 1931. 77. Dust Treatments of Cut Potato Seed. *New York A E. S. Bull. Nos. 602 & 610.* 78. Recreational and Forestry Uses of Land in Massachusetts. *Massachusetts A. R. S. Bull. No. 294.* 79. Bearded Iris—A Perennial Suited to all Gardens. 80. The Planting and Care of Shrubs and Trees. 81 The Peony: A Flower for the Farmer. 82. The Gladiolus: Its History, Classification and Culture *Cornell Univ. Extn. Bull. Nos. 112, 185, 220 & 231.* 83. Studies of the Genus Delphinium. *Cornell Univ. A. E. S. Bull No. 579.* 84. The Vegetative Propagation of Plants. 85. Some Effects of Freezing on the Physical and Nutritional Properties of Milk. *Maryland Univ. A. E. S Bull. Nos. 335 & 344.* 86. The Dietary Requirements for Fertility and Lactation: the Specific Effect of Vitamin B on Lactation and Growth. *Arkansas A. E S. Bull. No 284.* 87. Parshall Flumes of Large Size. *Colorado A. E S. Bull No. 386.* 88. Commercial Fertilisers, Report for 1931. The Mexican Bean Beetle. Microchemical Soil Tests. Potash Requirements of the Tobacco Crop. Tobacco Sub-station at Windsor, Report for 1931. Commercial Feeding Stuffs, Report for 1931. Report of the Director. Connecticut State Entomologist, Thirty-First Report, 1931. Chemical Investigations of the Tobacco Plant, Part III. The Food Value of Milk Report on Food and Drug Products for 1931. Profile Characteristics of New England Forest Soils. *Connecticut A. E S Bull. Nos. 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341 & 342.*

D. Circulars, Leaflets &c.

89 Parasites and Parasitic Diseases of Horses. 90. Outlines of Cotton Culture in the San Joaquin Valley of California. 91 Mechanical Application of Fertilisers to Cotton in South Carolina, 1931. 92. Conserving Food Value, Flavour, and Attractiveness in Cooking Vegetables. 93. The Citrus Insects of Tropical Asia. *U. S. A. Agri. Dept. Cir Nos 148, 256, 264, 265 & 266.* 94 Pollination of Fruit Trees. 95. Beans for New York. *New York A E. S. Cir. Revd. Nos. 132 & 135.* 96 Vegetable Storage. *New Hampshire Extn. Cir 119.* 97. Septic Tanks for Farm Homes. *Massachusetts Extn. Leaf.* 143 98. The Grasslands of Australia and some of their Problems: Report upon the Dairy Pastures. *Australia Coun. for Sci. & Ind. Res. Pamphlet No.* 39 99. The Marketing of Verum Cotton and Seed Distribution in Central Provinces and Berar *Ind. Cent. Cott. Comm. Pub.* 100. Requirements of Tree Workers in Connecticut Testing Vegetables for Connecticut Results for 1931 Lawn Seeding and Care The Elm Leaf Beetle Outbreak. Quarantine Restrictions Affecting Shipments of Connecticut Plants 1932. Regulations Concerning Transportation of Nursery Stock in the United States and Canada. *Connecticut A. E. S. Cir. Nos. 81, 82, 83, 84, 85 & 86.*

E. Reprints, Mimeographed Publications &c.

101. The Intake of Ions by the Plant and its Relation to the Respiration of the Root. 102. Pythium Root Rot of Broad Beans in Victoria. 103. Ferns as House Plants. 104. Bulbs Indoors. 105. Window Plants. 106. Native Shrubs and Trees for Ornamental Planting 107. Concrete Tile Sub-Irrigation System. 108. The Institute for Plant Protection: Its Problems and Structure. (Lenin Academy of Agri. Sciences U. S. S. R.).



RAO BAHADUR C. TADULINGAM MUDALIAR, F. L. S.

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THE TWENTY-SECOND COLLEGE DAY AND CONFERENCE, 1933.

There was more than passing interest in the Twenty-Second College Day and Conference which came off this year between the 21st and 24th. of October. With an interval of nearly two years since the last College Day, with the celebrations having had to be postponed to a period when the North-East Monsoon gets to be in full swing at Coimbatore, and with the functions closely following the coming of age of the Union, there had been considerable excitement, expectation and enthusiasm on the part of the members, resident and mofussil. We were fortunate in the midst of rainy weather to have a spell of bright sunshine, which enabled us to get through the programme in its entirety, to a very successful finish indeed. The celebrations were also marked by the intense enthusiasm shown by the student and officer members to make the celebrations worthy of the past traditions of the Union.

Extra interest centred round this year's celebration on account of its coinciding with the retirement of our very popular President, Rao Bahadur C. Tadulinga Mudaliar. He laid down his office on the afternoon of 23rd, the day on which the conference opened. On the 24th, for the later sessions of the conference, Mr. S. Sundararaman, Govt. Mycologist, who had taken charge from Rao Bahadur C. Tadulingam was the President of the Union. This year's Conference will therefore go down into history with the unique record, that the welcome speech to the guests was given by one Principal-President and the farewell by another.

Athletic Sports: The College Sports came off on Saturday the 21st October 1933. It had been raining incessantly on the Thursday previous and the state of the weather was such as to cause considerable anxiety to the several Committees responsible for the arrangements. The Rain God however called off his clouds from Friday onwards, with the result that we are able to hold the Sports on one of the brightest afternoons, that the sports have ever been witnessed here. There was a very large gathering of visitors and residents, and events were very hotly contested. Following the procedure set up in previous years, yet another item figuring in the Olympic contests was introduced in the programme; this was the Javelin Throw which attracted quite a large number of entries this year.

Student A. Maria Kulandai of Class II, won the Championship Cup with 45 marks to his credit, followed by P. M. Bennet of Class III with 28 marks. At the end of the sports, Mrs. Davis of the Forest College very kindly gave away the prizes. The following is a full list of prize winners of the various items :—

Cross Country Race:	**1. S. V. Parthasarathy; 2. G. Venkatarathnam; 3. J. Gopala Rao.**
100 Yards dash	**1. A Maria Kulandai; 2. P. M. Bennet; 3. James Colaco.**
Long jump	**1. A. Maria Kulandai; 2 P. M. Bennet; 3. T. Arunachalam.**
16-lb. shot put	**1. P. M. Bennet; 2. U. Ananda; 3. B. Suryanarayanamurthi.**
High jump	**1. A. Maria Kulandai; 2. P. M. Bennet; 3. Jame Colaco.**
Quarter mile race.	**1. A. Maria Kulandai; 2. James Colaco; 3. P. M. Bennet.**
Cricket ball throw	**1. P. C. Sahadevan; 2. K. Lakshmanan; 3. P. M. Bennet.**
Half mile race.	**1. S. David Kanakaraj; 2. D. Satyanarayana; 3. K. Jayaraman.**
Half mile (Invitation race)	**1. Cleur T. (Stanes European High School) 2. Syed Jamal (London Mission High School); 3. Munuswamy (London Mission High School.)**
Sack melee	**1. A. Maria Kulandai; 2. T. Ramanjulu: 3. K. Jayaraman.**
Javelin throw	**1. Narayana Pillai; 2. B. Suryanarayanamurti; 3. Sam Joshua.**
120 Yards hurdle.	**1. K. Lakshmanan; 2. A. Maria Kulandai 3. James Colaco.**
Old Boys' race	**1. P. G. Kurup; 2. K. Hanumantha Rao.**

One mile race	1. D. Satyanarayana; 2. S. David Kanakaraj; 3. M R. Devarajan.
Obstacles Race	1. M. Balakrishnan Nair; 2. T. Ramanujulu; 3. K. Jayaraman.
Inter-tutorial Relay Race	Mr. K. Ramiah's Wards
Inter-tutorial Tug of War	Mr P V. Ramiah's Wards.
Champion of the year	A. Maria Kulandai.

It is very gratifying to note that four records were broken this year. A. M. Kulandai, the champion of the year beat the previous records in Hundred Yards Dash and Quartermile of $10\frac{4}{5}$ seconds and $59\frac{1}{5}$ seconds respectively, by his performances in $10\frac{1}{5}$ seconds and $57\frac{4}{5}$ seconds. Kanakaraj David the College Half Mile winner, took away $5\frac{5}{8}$ seconds from the previous record of 2 minutes $26\frac{5}{8}$ seconds. In the Invitation Half-Mile, T. Cleur of the Stanes High School did it in 2 minutes $13\frac{1}{5}$ seconds, the previous record being 2 minutes $18\frac{4}{5}$ seconds.

Entertainments: There were two entertainments this year on the nights of 22nd. and 23rd. October. On the first night the entertainment started with an English Orchestra, which was followed by "Pandathe Pachan" a comedy in Malayalam and 'Yayathi' a drama in Tamil. On the second night an English piece "Doctor in spite of himself" was followed by "Ranapratap" a tragedy in Telugu. A unique feature this year was, that all the actors for the several dramas were only students of the College, and it has to be mentioned that they acquitted themselves very creditably with their very high standard of amateur acting; where one and all contributed whole-heartedly to the all-round success of the entertainments, it is difficult to pick out names, but mention might be made of M Balakrishnan Nair and M. Krishnan Unni Nair (Malayalam), C. K. Gopalakrishnan (Tamil), Sam Joshua (English) G. Satyanarayana and G. Satyanarayana Rao (Telugu); D. Satyanarayana in the Telugu Drama also impressed the audience with his delightful music.

The General Body Meeting: The General Body Meeting of the Union was held on Sunday 22nd. at 8 a. m. under the chairmanship of the President, Rao Bahadur C. Tadulinga Mudaliar. The minutes of the previous meeting were read and confirmed, after which the Annual Report including statement of accounts for 1931–33 and the Budget for 1933—34 were read and adopted. After this, the following amendment of which notice had been given was moved by Mr. V. Muthuswami Ayyar and seconded by Mr. S. Sundararaman.

Rule 5 b: Managing Committee, para 2:

1. Delete words 'the President (The Principal of the Agricultural College, ex-officio)' in the second line.

2. For the word 'two' in the fourth line, read 'three'.

The amendment to the rule was passed, *nem con*. The election of office bearers was then proceeded with. The following is a full list of office bearers for the ensuing year :—

COUNCIL (15).

1. Rao Bahadur C. Tadulinga Mudaliar. (President).
2. Dr. T. V. Ramakrishna Ayyar (Resident Vice President).
3. Rao Bahadur D. Ananda Rao (Moffussil Vice President).
4. Rao Bahadur M. R. Ramaswami Sivan (Moffusil Vice President).
5. K. Gopalakrishna Raju (Mofussil Vice President).
6. M. R. Balakrishnan (Secretary).
7. G. N. Rangaswami Iyenger, Editor.
8. Rao Sahib T. V. Rajagopalachariar.
9. G. Jogi Raju.
10. M. S. Madhava Rao.
11. K. Krishnamurti Rao.
12. Rao Bahadur T. S. Venkataraman.
13. Rao Bahadur B. Viswanath.
14. V. Muthuswami Ayyar.
15. G. Satyanarayana (Student).

MANAGING COMMITTEE (9)

1. Resident Vice President.
2. Secretary.
3. Editor.
4. M. A. Sankara Ayyar (Manager)
5. M. Rajagopala Ayyar (Treasurer).
6. C. S. Krishnaswami.
7. S. M. Kalyanaraman.
8. K. Ramaswami.
9. K. R. Sundaresan (Student).

EDITORIAL BOARD (7)

1. Editor.
2. Secretary.
3. Manager.
4. S. Narayanayya.
5. K. M. Thomas.
6. S. R. Srinivasa Ayyangar.
7. U. Narasinga Rao (Student).

At the end of the meeting Rao Bahadur T. S. Venkataraman congratulating the retiring Commitee on the new life that they have succeeded in initiating into the Union, proposed that the thanks of the General Body to them be recorded. He was seconded by Mr. K. Krishnamurti Rao and the resolution was passed unanimously.

The Secretary on behalf of himself and the Committee thanked the General Body for co-operation and appealed to all members present, resident and mofussil, to further the cause of the Union in every way.

Conference: On Monday the 23rd, the Conference assembled at 12 noon under the distinguished presidentship of Dewan Bahadur Sir T. Vijiaraghavachariar, K. B. E., Vice-Chairman of the Imperial

Council of Agricultural Research. After the President declared the Conference open, Rao Bahadur C. Tadulingam, President of the Union welcomed the visitors to the Conference. After this many messages of good wishes were read, prominent among which were from Mr. Allan Carruth, Mr. Hilson, Rao Bahadur M. R. Ramaswami Sivan, Mr. R. D. Anstead, Mr. P. H. Rama Reddi and Rao Sahib Y. Ramachandra Rao. Mr. M. R Balakrishnan, Secretary, then read the Annual Report for the period December 1931 to October 1933. After this, the following medals and prizes were distributed to the various prize winners by the President.

The Robertson Prize.	M. Bavani Shankar Rao.
The Clougaton Prize.	Y. V. Narayanayya.
The Kees Prize.	M. Bhavani Shankar Rao.
Dewan Bahadur A Raghunatha Rao Prize.	T. Venkatramana Reddi.
The D'Silva Memorial Prize.	V. Jayaraman.
The Anstead Medal.	K. Meenakshi Sundaram.
The Goschan Prize.	T. Ramanujulu.
Vhe Certificate Course Cup.	S. V. Parthasarathy.
Rao BahadurK. S Venkatarama Ayyar's Medal.	V. Sadasivan.
The Cuddapah Disfrict Agricultural Association Prize.	Y. Narasimhamurth. for class I. P. Rama Ra. for class II. T. Venkataramanu Reddi. for class III.
The Ramasastrulu Munagala Medal	T. Gopalarathnam.

Mr. S. V. Ramamurthi, I. C. S., Director of Agriculture, then unveiled the portraits of Mr. G. R. Hilson, Retired Director of Agriculture, Madras, and of Rao Sahib T. V. Rajagopalachariar, Retired Vice-Principal of the Agricultural College. In doing so, Mr. Ramamurthi made a speech, in the course of which, he said that Mr, Hilson joined the Agricultural Dept. in 1910 and for ten years was the Deputy Director in charge of the Ceded Districts and did excellent work not only on ragi and cholam but also on cotton in which his life work in this department had been mainly concerned. Mr. Ramamurthi also referred to Mr. Hilson's work for the evolution of Cambodia strains. He, the speaker, had the pleasure of knowing Mr. Hilson as Director, when he himself was Development Secretary and he had always found him as a man lovable and as an administrator, a man of sound judgment.

Rao Saheb T. V. Rajagopalachariar joined the department in 1902 and gained wide experience not only in the southern districts but also in the Northern Circars and the Ceded Districts and also had opportunities of special investigation of the conditions in Bombay Presidency and the U. P. Besides his wide experience, he had got a versatile knowledge and a forceful personality which had impresssed itself alike on his colleagues and his students. And as they would have expected, a man of his energy had not lost his interest in improved agriculture even after his retirement from official service. In unveiling the two portraits therefore, he, the speaker, would be unveiling the portraits of two distinguished members of the Madras Agricultural Service which had produced many able men.

He would like to make one suggestion. Mr. Hilson represented the research side of the work of the Department. Mr. Rajagopalachariar represented the teaching side of it. But there was a third side. He felt in unveiling the portraits that he missed a third. If he might say so, there was in agriculture as in universal life a '*Tirumurthi*'. Creation was represented by the researcher. Preservation was represented by the teacher. But where was the destroyer? They might ask 'destroyer of what?'; the destroyer of ignorance, of inertia, of wrong practices, of cruelty to plants, animals and man that starved in the midst of Nature that could give plenty, if only rightly asked. These destroyers were to be found in the districts. They were but few. But he hoped they would grow in numbers and when next they had an opportunity of honouring men who had left their impress in the Agricultural Department, he hoped they would remember not only the creator, the preserver but also the destroyer. He had great pleasure in unveiling the portraits which were got up by the Organisers.

The President then delivered extempore, his address which was listened to with rapt attention. The following papers (abstracts of which are published elsewhere in this issue) were then presented before the Conference.

1. "Agricultural Education—the Rural India needs" by Rao Sahib S. V. Kangasabai Pillai, B. E., Retired Assistant Engineer, Mannargudi.

2. "Perundurai Rural Vistas" by Mr. N. Lakshmanan, Perundurai Rural Centre.

3. "The Rapid Spread of Agricultural Improvements" by Mr. G. Jogi Raju, Assistant Director of Agriculture, Vizagapatam.

4. "The Yield Problem in Rice" by Messrs. N. Parthasarathy, S. Ramanujam and M. Narasimham, Assistants, Paddy Section.

5. "Investigations in the Second Crop Problem of the Godavari Delta" by Mr. C. R. Srinivasa Ayyangar, Superintendent, Agricultural Research Station, Maruteru, and Assistants.

The Conference adjourned for a group photograph at about 5 P.M.

On Tuesday the 24th, the second and third sessions of the Conference were held in the forenoon and afternoon respectively, when the following further 10 papers were presented:

1. "South Indian Bananas" by Mr. K. Cherian Jacob, Assistant in Systematic Botany, Coimbatore.

2. "Recent Cotton Improvement work for the 'Northerns' Tract" By C. Jagannatha Rao, Cotton Assistant, Nandyal.

3. " The present position of the Pempheres Problem" by Messrs. K. Dharma Rajulu, M. Suryanarayana, E. R. Gopala Menon and V. Marghabandhu, Assistants, Indian Cotton Committee, Coimbatore.

4. "Some Useful Experiences regarding Cane Cultivation and Manufacture of Sugar" by Mr. C. S. Krishnaswami, Farm Manager, Palur.

5. "A Note on the Breeding of the Thick Type of Canes for India" by Messrs. N. L Dutt, Second Cane Breeding Officer, Coimbatore, and M. K. Krishnaswami, Assistant.

6. "Low Prices and the Plight of the Lowly Ryots" (with special reference to Coimbatore) by Mr. S. V. Duraiswami, Research Student in Economics and Marketing.

7. "The Place of Economics in Agriculture" by Mr. T. Narayana Rao, Assistant, Millets Section, Guntur.

8. "Scope for Entomological work in the Districts" by Mr. P. S. Krishnamurthy, Assistant in Entomology, Guntur.

9. "The Present Position of the Red Hairy Caterpillar, the Major Insect Pest of South India" by Dr. T. V. Ramakrishna Ayyar, Government Entomologist, and Mr. K. Brahmachari, Assistant.

10. "Some Important Aspects of Dry Farming" by Dr. T. R. Seshadri, Chief of the Department of Chemistry, Andhra University, Waltair.

Several of the papers were followed by a discussion.

After the papers were read, the President referred to the passing away of Mr. V. J. Patel and paid a tribute to Mr. Patel's services to the country. He said that he first came into contact with Mr. Patel in the Assembly, when the latter was its President. There could be no two opinions about Mr. Patel's intense patriotism and his amazing courage. His name had become past history but he, the speaker, was sure that they would all agree with him that Mr. Patel's was a name which the twentieth century had contributed to the history of India. Reference to the death of Dr. Barber, former Sugarcane Expert, was also made. The President spoke on the scientific achievement of Dr. Barber chiefly on breeding work done on sugar-cane.

Another personage who passed away during the year was Rao Bahadur J. Chelvaranga Raju, who was a retired Deputy Director of Agriculture in this Dept. and the first Indian to hold that post. Mr. Raju gave his whole life time to Agriculture and was one of the few exceptions who took to agriculture and to the spread of agricultural knowledge among the people. The audience then stood in silence.

The President in his concluding remarks congratulated the Agricultural Union upon the excellent work it had accomplished in the last two days. He was particularly pleased to notice that there had been people outside the department who had contributed to their papers and discussions. That was a good sign. What was most needed in the department itself was a spirit of enthusiasm. Their department in Madras was particularly lucky in having an enthusiastic Director in the person of Mr. Ramamurthi (cheers). He was glad the same spirit prevailed at this colony in Coimbatore. He was looking forward to the time, when, from this centre would go forth workers whose motto would be to improve the agriculture of this presidency, to spread light where ignorance existed. He felt that there was a very hopeful sign that this place was going to be a nucleus of scientific institutions which in future years with more generous support of the State and with a more generous recognition on the part of the people, would develop into a scientific centre which would be of credit not only to Southern India but a centre to which visits would be made from distinguished countries in search of knowledge.

Mr. S. V. Ramamurthi, Director of Agriculture, in proposing a vote of thanks referred to Sir T. Vijayaraghavachariar's qualities and said that owing to his efforts for the last five years at the Imperial Council, they might regard India already to be federated so far as agriculture was concerned. To mark their pleasure and sense of importance at the visit of Sir. Vijayaraghavachariar, he had requested the Principal of the College to give a holiday to the students.

Exhibitions and Demonstrations: Advantage was taken of the large gathering present for the celebrations, by the Government Agricultural Chemist and the Research Engineer, to give demonstrations, the former on the methods of manufacturing cream jaggery, the latter on the working of Cooper Persian wheel water lift. Mr. K. Cherian Jacob who read a paper before the Conference on bananas, arranged as well, a very instructive banana exhibition featuring different varieties and interesting notes about bananas in South India and elsewhere. These exhibitions and demonstrations added very greatly indeed to the value of the Conference this year and the Union is very thankful to these gentlemen for taking the pains to provide interesting items for our guests.

Principal's Welcome Speech.

Dewan Bahadur Sir T. Vijayaraghavacharya, Mr. Ramamurti, Ladies and Gentlemen,

The very pleasant duty of welcoming you all to this, the 22nd College Day and Conference has once again devolved upon me as the President of the Madras Agricultural Students' Union, and that for the last time in my official career of over 32 years in the Agricultural Department.

Since I had the privilege of last discharging that duty in December 1931 in welcoming the Honourable Mr. P. T. Rajan, our Minister for Agriculture, a change has occured in the personnel of the Head of the Agricultural Department and we have today in our midst Mr. S. V. Ramamurti, our zealous, sympathetic and popular Director to whose hands the destinies of this department are committed during this period of economic depression, paralysing the unfettered development of this nation building industry. This depression notwithstanding, the members of the Union, students past and present have continued their efforts towards the advancement of this noble calling of Agriculture.

I avail of this occasion to offer our hearty congratulations to Messrs. T. V. Rajagopalacharya and N. S. Kulandaiswami Pillai on the title of "Rao Sahib" conferred upon them, and to express my greetings to Rao Bahadur D. Ananda Rao, my worthy successor in office.

In you, Sir, Mr. President whom we hail as one of the most distinguished sons of this city of Coimbatore, we have a strong support, as the Executive Head of the Imperial Council of Agricultural Research. You have already given a large impetus to the development of Agricultural Science to this vast continent of India and we in Madras are deeply grateful to you for helping to launch several schemes designed to further agricultural research and incidentally solve the chronic question of unemployment among young men and more especially among agricultural graduates. I take this occasion to appeal to you, Sir, to considerably improve the status of the field investigators under the crop costing scheme, so that the investigators' place might be sufficiently attractive to our agricultural graduates, who, I consider, are the best fitted men for enquiries of this kind.

A word in connection with agricultural education with which I have been in close touch for over two decades will not be out of place here. The huge number of applications for the B.Sc., Ag. course in the earlier years bears ample testimony to the attraction this education had; a gradual fall in recent years does not augur well. The causes of this decline need earnest scrutiny. Thanks to the munificence of the District Board of Coimbatore a new Short Course in Farm Management was recently started and we wish that that course every success.

On behalf of the Union and personally on my own behalf I extend a hearty welcome to you, Sir. for having graced this occasion and given me an opportunity to welcome you once again before I lay down my office as the Principal of this Institution. I consider it particularly fortunate that the deliberations of this session are presided over by you. You have without any reserve and with considerable wholeheartedness and at great personal sacrifice in the midst of your heavy duties, found time to come all the way from Simla to be in our midst and evidence your active sympathies with our Union, and I feel sure that under your helpful guidance the Conference will have a successful session.

Ladies and Gentlemen, I thank you for kindly responding to our invitation to be present here, and I extend to you all once again my most sincere welcome.

Secretary's Annual Report.

The Managing Committee of the Madras Agricultural Students' Union beg to submit a restrospect of their tenure of office for a period of 22 months from December 1931 to October 1933. For more reasons than one the period under report has been one of the most unique in the life of the Madras Agricultural Students' Union and the Journal associated with it. The last College Day was held in December 1931 and due to the fact that the annual celebrations could not be arranged during 1932, we have had an interval of nearly 22 months, the longest on record between two successive celebrations. The financial and economic depression which started some 3 or 4 years ago all over the world reached a crisis during this period and had their concomittant effects on our activities as well. We were on the threshold of an economic crisis when we started the year 1932 and this developed into acute symptoms, all round, necessitating retrenchment, cut in pay and various other financial adjustments that Government, business and professions had to make. Political and social convulsions that shook our country and the outside world apart, agriculture received a set back not on account of the need to produce more but by the difficulty caused by over-production, slumps in the market, and the difficulties experienced in balancing an economic budget. Rubber, tea, and coffee to mention a few among the Planter's products, wheat and paddy amongst the grains, coconut, cotton and sugarcane amongst the industrial crops, all had their share in this adverse condition of things. And each country was set with the task of solving its own problem according to its own peculiar conditions. Almost incredible as the stories of the Arabian Nights, will seem to posterity, the unique uses that food and other crops were put to. Quite a long while since perhaps, in the history of the world, came the custom of the yield of agricultural crops being reckoned as barter in place of hard cash. College and tuition fees in America were paid not by dollars and cents, but by grain. Soviet Russia found a new use for her excess wheat by using it as fuel instead of for human consumption. Sugar Syndicates and Coffee Planting Organisations came to conclusions to restrict area under cultivation and even to annihilate plantations on which labour and energy had been lavishly spent. To add to the difficulty of the farmer and the landholder who were faced with the disposal of their excess, floods, and earthquakes had their toll in several parts of the globe. Banks crashed, countries which had been powers in the financial world were obliged to go off their gold standard; currency had its value changed; and the universal paradox existed with every one possessing enough to keep the wolf from the door, and yet financially and economically uncertain and unhappy.

To a certain extent this over-production was a blessing in disguise. It stimulated human thought; talent and dormant genius was awakened; research brains were bestirred to activity. New and peculiar uses were invented and discovered for articles which had come down to us with an ancient association about them of their particular utility. While agriculture suffered, industry showed signs of developing. The whole world began to realise that success awaits those who only are able to adapt their production and manufacture to changed conditions and thus, conservatism slowly began to disappear. The necessity for international talks, understandings and conference became apparent and all progressive nations have come to realise that beautiful concept of world organisation where every couutry is a happy unit with friendly exchanges and where agriculture should be the basic and the supporting industry for the ultimate happiness of all mankind.

That indeed was the crux of the whole problem. For with all this over-production and slump, the cries of back to the land have been foremost in the air during the past two years. It is perhaps a happy sign that humanity has realised that a great deal of happiness, material and spiritual, can be attained by honest toil on the soil, by the appreciation of the dignity of manual labour and by the promotion of the factors of self-reliance, self-content and self-knowledge.

The Union and the Journal were also affected in this whirlpool of financial maladjustments. Coming on the wake of cut in pay and depending mainly on the co-operation and sympathy of departmental officers, the Union would certainly have sunk into insignificance but that departmental officers and public spirited men interested in scientific agriculture stood by us staunchly and helped us to keep our heads above water and tide over the crisis.

UNION ACTIVITIES

College Day and Conference: The Twenty-first College Day and Conference came off from 19th to 21st of December under the presidency of the Hon'ble Mr. P. T. Rajan, Bar-at-law, Minister to the Government of Madras. The College Day had purposely been postponed from July to December as it was at that time expected that the Gazetted Officers' Conference would also be held in December, and as such we could have them present for the College Day. Unfortunately, however, on account of financial reasons, the Government could not permit the holding of the Gazetted Officers' Conference and as a result we had to miss for the second time familiar faces at the College Day and Conference. The several items of the function were gone through very successfully thanks to the labours of the various sub-committees.

Athletic Sports: These were held on Saturday the 20th December and the events which were very hotly contested were, following the convention of previous years, run on olympic lines. Records were broken in Quarter Mile and equalled in 100 Yards and High jump. P. M. Bennett of Class I, who was the Champion of the year having to his credit two of these achievements. At the end of the Sports, Mrs. Wrench of the Forest College, very kindly gave away the prizes.

Entertainments: On the night of the 20th, the students staged "Madhuseva", a social play in Telugu, and "Anandapalan", a drama in Tamil specially written for the occasion featuring current ideas in an ancient setting. All the actors acquitted themselves very creditably. One noteworthy feature was the yeoman service rendered by the Boys Scouts of the Estate who helped in fitting up the state enclosing the main hall and arranging seats, the whole work being a practical application of scout craft

General Body Meeting: The General Body Meeting of the Union was held on Sunday the 20th at 9 a m. under the chairmanship of Rao Bahadur Mr. C. Tadulingam at which resolutions were moved and discussed and office bearers elected for the ensuing year.

The Ramasastrulu Munagala Competition: As in the past this competition elicited very poor response from members this year also. Only one paper was received, but the judges considered it to be of sufficient merit to be awarded the prize. The Ramasastrulu Munagala medal goes this year to Mr. P. Gopalarathnam, Cotton Assistant, Guntur, for his paper on "Studies in Capsicum". Our thanks are due to the judges, Messrs. G N. Rangaswami Ayyangar, N. L. Dutt and Dr. J. S. Patel.

The Conference: Punctually at 9-30 a. m. on Monday, the 21st December, the Conference assembled in the main hall of the Research Institute under the distinguished presidentship of Hon'ble Mr. P. T. Rajan, Minister for the Public Works. Many messages of good wishes were read after which Rao Bahadur Mr. C. Tadulingam, the President of the Union in a neat little speech welcomed the Minister and the guests to the 21st College Day and Conference. Mr. K. M. Thomas, Secretary of the Union, then read the annual report which recorded all round progress of the Union. The President then delivered his address. It was listened to with rapt attention. The following six papers contributing a symposium on sorghum were then read:—

1. "Sorghum in western taluks of Bellary" by R. Nagan Gowda, Ph. D., Hospet.

2. "Sorghum improvements in the Madras Presidency" by Mr. K. Gopalakrishna Raju, District Agricultural Officer in Charge, III Circle.
3. "Sorghum the Great Millet" by Mr. G. N Rangaswami Ayyangar, Millet Specialist.
4. "Chemistry in the production and utilisation of sorghum" by Rao Bahadur B. Viswanath, Government Agricultural Chemist.
5. "The Entomology of Sorghum Plant" by Dr. T. V. Ramakrishna Ayyar, Government Entomologist.
6. "The Sorghum Diseases" by Mr. S. Sundararaman, Government Mycologist.

The reading of papers was followed by a discussion and after the President's concluding remarks. the Conference closed with a vote of thanks by Rao Bahadur D. Ananda Rao. Three hearty cheers to the Minister proposed by Mr. C. Tadulingam, were lustily responded to.

The Journal: This important all the year round activity of the Union, was quite in evidence during this period and the standard and punctuality attained by the previous Committee and the Editorial Board were maintained. The Managing Committee and the Editorial Board co-operated wholeheartedly during the crisis and while a great economy was effected the standard was even sought to be raised. New features like 'Abstracts' and 'Crop and Trade Reports' were added. This coupled with the fact that a number of our officers are now willingly coming forward to publish the results of their work in our Journal we have been able to establish contact with workers in other parts of the world from whom there have been constant demands for particular copies of our Journal, and who in their turn enriched our library, by sending us in exchange some of their valuable publications.

GENERAL ACTIVITIES

M. A. S. U. Parliament: Under the auspices of the Parliament a debate was held at which Mr. V. D. S. Ayyangar of the R. K. Mills, Peelamedu [illegible] moved and Mr. D. G. Munro, Deputy Director of Agriculture, Coimbatore, opp[illegible] the Cotton Control Bill is not conducive to the best interests of the [illegible] Mr. C. V. Venkataramana Ayyangar was the speaker for the occasion.

Under the Auspices of the Union, a meeting was held to bid farewell to the final year students who passed out of the college and to wish them all success in their life.

Condolences: Twice during the period, have the Resident Members had to meet, once in November last to exprese our condolences on the passing away of Rao Bahadur J. Chelvaranga Raju one of the Founders of the Union, and for a similar purpose in March again this year when news of Dr C. A. Barber's death was received by us. Resolutions expressing our sympathy to the members of the bereaved families were sent.

Conclusion : The Madras Agricultural Students' Union has attained its majority; the Journal associated with its inception which originally started as an Year Book, has developed into a fullblown monthly which has secured for itself a place of esteem with other journals, a warm corner in the hearts of old boys and officers of the Department, and an attachment to all those who have been associated with it. During the years to follow it is the fervent wish of the Managing Committee that the Union besides conducting the Journal will continue to do useful service for old boys of the College as well In the earlier years when most of these were getting absorbed into the Department conditions were not so acute. At present however the Union serves as the only connecting link between old students and the Agricultural College, and it will be one of the sincere endeavours of this parent body to look to the interests of these members of our Union and to request august bodies like the Imperial Council of Agricultural Research and the Indian Central Cotton Committee who are in a position to finance a number of short and temporary schemes to relieve unemployment amongst these despondent youths and to encourage them with a decent start in life.

Vote of thanks: The Committee wish to express their grateful thanks to all those ladies and gentlemen who responded to our invitation at the time of the last College Day and Conference, to the various Committees that laboured for the success of the function, to Mr. R. C. Broadfoot and Rao Bahadur C. Tadulingam, Principals of the College during this period, and Rao Bahadur D. Ananda Rao, Headquarrers Dy. Director of Agriculture, for the great interest they have evinced and to Mr. S. V. Ramamurthy, Director of Agriculture, for his sympathetic appreciation of our work and the desire he has more than once evinced to help us financially and otherwise.

The Managing Committee further take this opportunity on behalf of the Madras Agricultural Students' Union, to offer their very hearty congratulations on the titles conferred by the Government on Mr. C. Tadulingam and Mr. T. V. Rajagopalrchariar, Retired Vice Principal of the College, the President and the Resident Vice-President of the Union during the period.

Messages.

Mr. Allan Carruth O. B. E. It always gives me much pleasure to see that College Day has come again, and as a member of the Union I should very much like to be present.

While many things contribute to the success of the various aspects of College Day, none has such an important effect as the Chairman, and I congratulate the Union on being fortunate enough to obtain the services of Dewan Bahadur Sir T. Vijayaraghvachariar Kt., K. B. E., Vice-Chairman of the Imperial Council of Agricultural Research. I sincerely hope that nothing will come in the way of the chair being taken as arranged as his presence confers a great honour on the Union and will encourage us all in our efforts to progress.

The problems of the different countries tend to become more difficult in these recent years, and let us hope, that our members may be able to contribute towards a solution. The opportunities which College Day affords for discussion of topics from every angle must be fruitful in good work.

It is my earnest hope that the celebrations will be a success from all points of view, and that our members will feel encouraged in a work which should bring prosperity and happiness to the people.

Now for a personal note. It is some time since I had the pleasure of giving a subscription to the funds of the Union. The monthly Journals keep me reminded of my connection with the Union, and I relish the high standard of the contents. I enclose an order for Rupees One Hundred to the general funds of the Union, to be used for any purpose the Committee may decide.

As one member of the Union to another, you would be interested to see my name included in the King's Birthday Honours List on June 3rd. last, under O. B. E. officers of the Order of the British Empire.

In my work when amongst you I appreciated the encouragement from the Union, the inspiration from College Day and the helpful attitude of the people in Madras, and I now ask you to accept the enclosed token of my gratitude to you all.

Trusting that this message finds you all in the best of health and spirits. With the best wishes for the success of College Day.

Mr. G. R. Hilson. Please convey my kind remembrances to all members of the Union and my heartiest congratulations on your twenty-second Birthday, I hope you will have a lively, interesting and fruitful meeting. My best wishes for the continued progress of the Union.

Hon'ble Mr. P. T. Rajan. Thanks very much for your kind invitation to be present on the occasion of the celebration of your College Day and I regret my inability to accept the same owing to a previous engagement. However, I wish your function every success.

Mr. R. D. Anstead C. I. E. You have been good enough to ask me to send you a message of greeting on the occasion of the 22nd. College Day. In doing so my thoughts pass back to many years of pleasant work at the College and to occasions on which I occupied the Presidential Chair at this annual function. They also stretch forward—what does the future hold for this College ? Great waves of political argument bringing changes in their wake will no doubt sweep over it but I feel sure they will leave it standing as firmly as ever to fulfil its task which is changeless. Whatever political regime prevails and whosoever rules, the people must be fed and the interests of the ryots must be safeguarded, and this is the task of this College and the Agricultural Department.

Science has placed in the hands of man many new powers, the control of energy, rapid transport and easy communication by telegraph and wireless, crops so improved that they yield more, resist diseases and defy climate, control over the soil in which they grow, and above all greatly improved health for the people. But man has not yet learned to take the best advantage of these discoveries. They have come more quickly than his powers of absorbing and utilising them, and the inevitable consequence is summed up in phrases like " unemployment ", and " economic crisis ".

What the whole civilised world needs at the moment more than any thing else is an organised plan, and until that plan is devised world troubles will remain. A plan will undoubtedly be devised—a plan which will co-ordinate all the wonderful gifts of scientific discovery and utilise them for the utmost good of mankind.

What part will this College play in the devising of that plan ? Hitherto agricultural scientists have devoted most of their attention to the improvement of crops, their protection from disease and the creation of produce. In the future they must pay more attention to the orderly distribution of this produce both on the soil and in the market, and research must turn in that direction Markets must be critically examined, great surveys of production made, as soil surveys have been made in the past, with the view to ascertaining the best places in which to grow specified crops. The same patient methods of research must be devoted to such problems as these as has been devoted in the past to the study of production and disease, and rest assured the result of such research will be equally prolific of solutions of the problems studied.

It is not impossible to imagine a system of international control which, while leaving each country to determine production for its own consumption, would regulate the disposal of surpluses in a way which would prevent the forcing of excessive quantities on an unwilling market, and thus secure the maintenance of a relatively stable price.

You students at this College have a great opportunity of playing your part in the reorganisation of the world plan, which, believe, me, is going to take place in the near future. I wish you every success in your labours.

Rao Bahadur M. R. Ramaswami Sivan :— I am writing to thank the President and members of the Madras Agricultural Students' Union, for their very kind invitatation for the College Day and Conference. Several prior engagements which I cannot easily put off, prevent me from being present and taking part in the Sports on one side and in the discussions at the Conference on the other.

I am particularly sorry that I have to be absent this time for several reasons. First, the Conference is to be presided over by no less a distinguished person than Sir T Vijayaraghavacharya, whom I can take the liberty of considering as one of my oldest friends. Secondly, your sympethetic Director of Agriculture, has, I understand, schemes for the relief of unemployment among agricultural graduates, and I should have liked to have listened to his schemes, in person. Thirdly, this is probably the last time when Rao Bahadur C. Tadulingam will welcome old boys and distinguished visitors in his capaclty as President of the Union.

I shall miss the Sports and the Old Boys' race, and I shall thank you to convey my apologies to your Sports Secretary, Mr. M. C. Cherian.

I trust that the rains will hold off on the Sports Day and I wish the Conference all success. Please convey my greetings to all old boys.

Presidential Address.

In the course of his address, the President said that he really did not know on what to speak. He had first made up his mind to speak on tariffs and quotas and things of that sort, but recent events forbade him from entering that rather dangerous ground. What had happened that day and what the Secretary had said had suggested to him some thoughts. And perhaps they would bear with him if he spoke to them upon his impression of them. He was afraid he could not given them a learned scientific discourse. But he could do the next best. He could express an administrator's strong feelings about the important function which scientists played in the life of the country, the position which they occupied at present and they would occupy in future. When he thought of what was going on around them, of financial retrenchment and the need for economies, he wondered why in all Governments, whether in the East or in the West, scientific departments were first chosen as the proper victims for financial operations. What was the depression due to? They had several theories about the depression, but everybody agreed that the depression was primarily one in agricultural products. One should have supposed that when they had got to deal with agricultural depression, far from retrenchment in the scientific departments dealing with agriculture, they would rather increase the staff, and strengthen the forces which dealt with the depression. The Army Department was not in the habit of retrenching when there was an enemy at the gates and he should have supposed that speaking like a layman, when there was agricultural depression, far from thinking of retrenchment in the agricultural departments, Governments all over the world should rather strengthen them. He could not explain the paradox.

A SUGGESTION.

One suggestion he would venture to offer in all humility. Just as the Government of India provided that certain members of the

Viceroy's Council should be lawyers, and so on, so in the coming constitution, provision should be made that one member of the Viceroy's Council should be a scientist or a man who had scientific training. He thought the trouble arose from the fact that it was just the old medieval notion. In the middle ages, they considered that people who worked in laboratories and discovered things were magicians, wizards that ought to be burnt. They were now more civilised in their methods. Nowadays, they did not burn agriculturists and scientists. They just retrenched them.

They had heard a great deal about depression. They had had a learned investigation. But how far India was connected with the depression, in what way she ought to meet her own special problems was a work which ought to occupy the minds of all administrators at this time. One should have supposed that on an occasion like this, they should have a staff of people, apart from scientists, versed in agricultural ecnomics who would deal with these questions from the special point of view of India. But what did they find? Hardly was there anybody who dealt with agricultural economics. Let them take the Imperial Council of Agricultural Research. One should have supposed that that Council could have had an eminent authority on agricultural economics. But there was none. There were very many problems in which they were interested and the field was very large. They were dealing with possibly the largest agricultural country in the world. And they were dealing with a country which, however much it might be industrialised in the future, would still essentially remain an agricultural country.

A TALE OF FIGURE

What was the amount which the Imperial Government or Provincial Governments spent upon agriculture? The calculation was made some time ago. It was 8 pies per cultivated field in India, 4 annas in Japan and 8 annas in the United States. These figures would tell their own tale. On an occasion like this, he should think, young men of this College, men who had gone out of the college and those who had gone out from similar colleges elsewhere in India, should be men who would take an important and prominent part in dealing with the problems of national rebuilding. They had still got to recognise the value of scientific departments and they had still to allot liberal funds for that purpose. He was almost ashamed to tell a visiting American or a visiting European, when he asked him what was the amount given to the Imperial Council, to say, it was 5 lakhs. He should say fifty lakhs would be a moderate sum for the Council which dealt with the whole of India,

In the next two years they hoped to see a new Government and a new form of constitution. When it did come he hoped there would be

. a much more increasing recognition of the value of scientific research. There was an increasing recognition in every province and particularly amongst the non-official communities of the value of scientific research, particularly in agriculture and he earnestly hoped that when the new form ot Government came in, the Agricultural Department would play a very much larger part than it had done, that a great deal of work would be done by them and that funds would be increased year after year and that India would have a proper research staff equipped with agricultural knowledge and competent to deal with agricultural problems. He saw no other way out of the economic difficulties.

AGRICULTURE AND FOOD RESOURCES.

Let them take the question of food resources. There were two direct opposite points of view. One point of view was one with which they had been historically familiar, viz., that population was outstripping the means of subsistence. But latterly on account of scientific discoveries they had rather altered that point of view. But the problem was still left as to whether they had got adequate food resources. It was only the other day he was talking with a man to whom Indian trade was official business. And, somebody said to him about increase of production. He said, "My God, of course, what was necessary was cutting down of production, I wish people would start a camgaign for burning fields and stocks of grain." What was the proper view to take? Was it the correct view to take that in a country like this with 353 millions of people and where it was said only 70 millions got a single meal a day, that their food resources were much more than necessary and that they should be reduced? Why did it happen that food was so cheap, that the agriculturist did not find it worth while to raise his crops but at the same time there was a population of 70 millions who could not get it? What was the defect in the system which brought it about? That was the kind of question which he would like the agricultural economist to deal with. Let them take other things. Let them take the question of mechanical helps to cultivation. There was a particular committee of the Imperial Council which had been concerned with that particular subject. But only the other day he saw an administrator of an Indian State and was talking to him about that committee. He said he would put down mechanical improvements to cultivation at once. Already they were complaining of unemployment. The more machines they employed in the field the more labourers there would be thrown out. He said the very first thing to be done was to abolish all agricultural machines and to get on with human labour. What was the correct answer to that problem?

Then of course, there was the question of agricultural depression. He had been asked what were the remedies he would suggest. To raise prices? He was afraid nobody there could suggest what were the means by which they could raise agricultural prices. They could suggest temporary remedies in order to make the agricultural debtor less heavily burdened by his debts. But what the permanent remedies were, one did not know. Two years ago, they consoled themselves with the general belief that this depression was bound to be a temporary thing, that they got alternately periods of boom and periods of depression and that the depression would end and would be followed by boom. People saw signs of improvement two years ago. They were still trying to detect those signs and he for himself could not say he detected any. One thing seemed to be clear that if prices were to be raised—and that was the most urgent question in agricultural commodities,—it must not be by the action of one country but by the countries of the civilised world acting together. Then only they got anything towards solving that problem. He had discussed it with various people who were being concerned with such questions in more than one country in Europe. The thing that impressed him, was, that the whole trouble was due to the economic nationalism which had been fostered as one of the after-effects of the war. Till they got rid of that there was no chance of improvement. Personally it struck him that a better spirit had come over the countries of the world. He had recently been in Europe and he took some pains to converse with people who knew about this. The impression that was left on his mind was that Europe was sick unto death and unless a new sprit passed over the world and commonsense again got hold of the nations, this generation would see the collapse of what they called western civilisation.

THE ECONOMIC CONFERENCE AND AFTER.

Very much faith was attached to the World Economic Conference. He supposed they all knew how the Economic Conference ended. Everybody recognised the fact that tariffs were bad but everybody was anxious that the other nations must take off their tariffs while retaining his own. It reminded him of the old Madras story about the manner in which milk was raised in a particular village for festivals, each villager pouring a cup of water into the cauldron imagining that others would pour milk. Most of the nations of the world were under similar ideas. It was a very difficult problem but he was not really interested in problems outside except to the extent that the solution of the world problem meant the solution of the Indian problem.

Coming nearer home what was to be their attitude towards these questions, towards tariffs, import duties, etc. All those were questions in which the agriculturist was vitally interested and on which they should have a staff of agricultural economists working. But there was no doubt whatever that they would have to tackle the question and the responsibility would come very soon to Indian hands. It was easy now when the other man was in power to criticise him. But very soon they would be in the seats of the mighty. They would find then the administration not quite easy. How were they going to deal with the problem?

There were many things in which the assistance of economists could be useful. Let them take the question of sugar. They all knew what an enormous development had taken place in the Indian manufacture of sugar in the last four years. The question now was whether this should be ordered, planned and controlled by the State or should be left to the initiative of private firms. That again was a matter on which economists would be able to advise. There were two schools of opinion on that. The supporters of State control quoted the example of Java. But Java was a small country and rights of property were not the same and political conditions were also different. All these were matters on which they would like investigations by skilled economists. He should strongly recommend to the ministers of the future government of India to employ agricultural economists not only in the centre but in every province. The more money they spent upon agricultural research the less they would have to spend upon police, jails, magistrates etc.

A LESSON FROM WORLD DEPRESSION.

To the members of the Madras Agricultural Students' Union, he would say that some of the things he had said might appear rather unfashionable but he was perfectly certain that one of the good results of this agricultural depression would be an increasing recognition by all nations, of the value of scientific and economic research in the field of agriculture. Whatever might appear to be their prospects to-day, he believed that in the future life of this country, people who had been trained in colleges like this had got a very large part to play a very much larger part than gentlemen who went out of the law and other colleges. Let them not be downhearted. Let them consider themselves that they belonged to a profession which was bound to add to the wealth of the country. They had got a fine and noble career before them. There might not be as much recognition on the part of the State to-day as it would be in the future. Far from taking a pessimistic view of the future, they should realise that more and more administrators, statesmen and politicians would begin to recognise the value of their work. (Loud Applause).

Abstracts of Papers.

1. "ARICULTURAL EDUCATION—THE RURAL INDIA NEEDS" by Rao Sahib S. V. Kanagasabai Pillai B. E., Retired Assistant Engineer, Mannargudi.

In the present day cry of back to the land, the several factors, like, awakening the individual rather than providing his needs, the necessity for a determined will, and the ways our resources are frittered away, are overlooked. The paper deals with the failure of the agricultural graduates to lead as agriculturists, the educative value of the Agricultural Department, and the suspicious conservatism of the villagers and after referring to the example of rural Denmark, focusses attention on the need to train the labourer as well as the landlord, and puts forth a plea for the opening of a number of central elementary schools with an agricultural bias. The paper winds up with a reference to the wealth of agricultural lore buried in vernacular literature of the past, and with an appeal for the intelligent and useful study of this literature.

2. "PERUNDURAI RURAL VISTAS" by N Lakshmanan.

After his tour in India with the Agricultural Commission and from local experience, the author thinks that the hope of the farmers of Perundurai lies in the early fulfilment of the recommendation of the Royal Commission that the Agricultural Department should pay greater attention to the problems of cultivation in dry and precarious tracts. It is comparatively easy to change the outlook of farmers who are the members of the well-conducted co-operative societies. The good co-operative society serves as "the natural basis" for comprehensive rural reconstruction. While alive to the fact that Adult schools are everywhere difficult to maintain the Perundurai Rural Reconstruction Centre is just now experimenting with seven schools for adults of different strata of the village community. The system of. Intellectual Conscription advocated for years by Mr. S. V. Ramamurthi, I. C. S. deserves to be introduced, at first, in the rural reconstruction centres. Co-ordination of the activities of nation building Departments is fruitful at the Perundurai centre. The need of the hour is to enable the local staff to take an active part in this field of work. The Perundurai Rural Reconstruction Centre as elsewhere serves as a living link between the unorganised villagers and the expert officials.

3. THE RAPID SPREAD OF AGRICULTURAL IMPROVEMENTS by G. Jogi Raju.

As a result of the Gazetted Officers' Conference in 1930, propaganda work has been concentrated in 3 or 4 centres in each sub-circle, the greater contact with the ryots of the central villages facilitating the rapid spread of improvements in those villagers at first, and thereafter to the villages around. This system has been found fairly successful in 12 out of 25 centres in the six sub-circles in the Vizagapatnam district where work has been going on for 3 years past. The demonstrator does the preliminary propaganda work in each central or other village and the Demonstration Maistry or Demonstration Cooly pushes on the improvements further, by assisting the ryots in adopting them corretly. Progress depends upon the presonality of the staff and their attitude towards their work. A spirit of service to the country is badly needed. A system of awarding marks for the work turned out by each Demonstration Maistry or Demonstration Cooly and cutting down wages for shortage for a fixed minimum has been adopted during the past 6 months with fair success so far. A demonstrator should be able to gradually guide and supervise the work of 8 Demonstration Maistries or Demonstration Coolies one being stationed in each centre from which about 25 villages around with a five miles' radius can be tackled. If a demonstrator is provided for each taluq with (in the course of five years) 8 Demonstration Maistries or Demonstration Coolies, departmental activities can be made to reach almost every village in the district. Taking the Vizagapatam district as an example, 3 additional demonstrators and 87 demonstration coolies will be required, the latter costing Rs. 15,000 per annum ultimately in addition to the present expenditure—a sum certainly not too large considering ultimate effects.

4. THE YIELD PROBLEM IN RICE By N. Parthasarathy, S. Ramanujam and M. Narasimhan.

The final yield of a plant is only an end result, and any attempt to improve the same must depend upon a comprehensive knowledge of the several attributes to yield, and how each of these attributes is influenced by the environment in which the plant grows. The paper deals with an intensive study of the rice plant, and the different phases of its development in relation to its environment.

Several cultural experiments have been carried out at the Paddy Breeding Station, Coimbatore; spacing and population density, age and condition of the seedling at transplant time, application of fertilisers all at once or at different periods during the growth, manuring the seedbed rather than the transplant field, broadcasting versus transplanting, etc., and the results of these experiments are discussed in relation to the development of the plant and the analyses of final yield. As a result of these studies suitable modifications of the cultural practices are recommended to get the maximum benefit.

5. "INVESTIGATIONS IN THE SECOND CROP PROBLEM OF THE GODAVARY DELTA" By C. R. Srinivasa Iyengar, & Assistants.

The second crop paddy occupies at present an area of nearly two lacs of acres under the Godavary Irrigation. Commencing with a brief description of the history of the second crop cultivation in the delta, the paper discusses the main problems involved. Next, the results of the investigations undertaken at the Agricultural Research Station, Maruteru, to solve the difficulties through breeding and modifications in cultural practices are elaborated. It is found that raising the seedlings initially under semi-wet conditions and thereafter allowing them to dry up, when enough growth for easy pulling is obtained, appear to be satisfactory. The planting time can then be regulated within limits, to the convenience of the cultivator without affecting the yield. The paper then draws attention to the economic aspect of direct manuring for the short second crop in preference to the long duration first crop paddy. In conclusion a brief reference is made to the study of the methods of storing the second crop seed without impairing its vitality and to treatment of seed against the outbreak of 'Foot Rot' disease commonly appearing in the second crop.

6. "SOUTH INDIAN BANANAS" By K. Cherian Jacob.

After dealing with a short history of the banana, one of the oldest and the most popular of fruits, the paper refers to the distinction between banana and plantain, the area under banana and the methods of cultivation. Proceeding, the author refers to the large number of local varieties of which there are 400, and gives particulars in detail of vernacular names, the morphological characters, the chromosome numbers, etc. The paper concludes with a general reference to the existing trade in banana, and the possibilities for the future, by breeding and selection, and the need for intensive study—scientific and economic—of the subject.

7. "RECENT COTTON IMPROVEMENT WORK FOR THE 'NORTHERNS' TRACT" By C. Jagannatha Rao.

The position of the "Northerns" area with reference to Indian and World cotton areas is pointed out. With an introduction as to the object of the existence of the Nandyal Agricultural Research Station, the merits and demerits of N 14, a cotton strain evolved at the station and under distribution to the ryots for the past few years are briefly discussed. This is followed by a succinct review of the history of some of the new selections recently evolved on the station together with a list of their chief characters. Future programme of work on them and their probable prospects are indicated.

8. "THE PRESENT POSITION OF THE PEMPHERES PROBLEM" By K. Dharma Rajulu, M. Suryanarayana, E. R. Gopala Menon and V. Margabandu.

Of the various insects that attack both the exotic and indigenous types of cotton in South India, *Pempheres affinis* is of considerable importance. This paper presents a resume of the work done so far on the study of the bionomics, habits and life history of the insect and of the control measures that suggested themselves during the course of these investigations. It has been found that this insect has a life cycle of about 3½ months and has very few alternate host plants. No evidence of the existence of definite broods was obtained. As possible means of controlling the pest, the following aspects of the problem are studied in some detail.

1. Biological control by the use of certain parasitic fungi.
2. Utilisation of the defensive mechanisms of the plant.
3. Artificial methods such as (a) the use of repellants (b) suitable manurial and cultural practices.
4. Indirect methods such as;—
   (a) Breeding of early varieties, and
   (b) Vernalization with a view to cut down the growing period of cotton so that a longer close period may be observed.

9. " SOME USEFUL EXPERIENCES REGARDING CANE CULTIVATION AND MANUFACTURE OF SUGAR " by C. S. Krishnaswamy.

The paper details the various improvements tried on the Palur Agricultural Research Station, with a view to reduce the cost of cultivation of sugarcane, under the heads (1) Preparation of the land; (2) Seed preparation and planting; (3) Seed rate; (4) Intercultivation; (5) Banking, Propping and Tashings. The results of experiments conducted on the proper rotation and manuring bring out certain useful lessons. Full economics of the manufacture of jaggery and white sugar are also given.

10. "A NOTE ON THE BREEDING OF THICK TYPE OF CANES FOR INDIA" By N. L. Dutt, and M. K. Krishnaswami.

The thick or tropical type of canes is grown chiefly in the southern and peninsular India, Burma. parts of Bengal, Assam and North-West Frontier Province. In the three main sugarcane growing provinces of India—United Provinces, the Punjab and Bihar-the thick type of canes is grown for chewing purposes—United Provinces alone growing 75,000 acres. Four and a half million tons of cane, i. e., twelve per cent of the total output of cane are consumed annually in India for chewing.

Breeding of new canes is now the accepted method for improving the sugar Industry, in almost all sugar producing countries. Considerable success has resulted from sugarcane breeding in most countries. The variety POJ. 2878 has raised the production of sugar by 18 per cent in Java, and the improved Coimbatore canes like Co. 213 and others are now occupying one-third the total are under cane in India. The increased output from growing Co. canes in North India may be put as fifty per cent.

The systematic breeding of thick or tropical type of canes was started at Coimbatore in 1926. In the breeding of the thick type of canes the aim has been to produce types which would cost less to grow and for this purpose it has been found useful to introduce blood of the hardy, thin and medium types. In the year 1931, the first batch of eight seedlings was distributed to various Provincial Experimental stations. The task and credit of finding out the most suitable seedling variety for a tract after critical trials belong to the officers of the Provincial Departments of Agriculture. Till now 29 seedlings of the thick type from the area devoted to the breeding of such cases have been distributed and certain of these seedlings have given a good account of themselves. Cos. 402 and 408 appear to be the two outstanding seedlings. The former is a good yielder and possesses the advantage of not being prone to flowering. Co. 408 is a heavy yielder, has a good root system and its jaggery is of a high quality.

11. "LOW PRICES AND THE PLIGHT OF THE LOW RYOTS" (WITH SPECIAL REFERENCE TO COIMBATORE DT.) by S. V. Doraiswamy.

Perhaps no problem is discussed so much as and with deeper attention by economists in recent times, than this epidemic of low prices and the cure thereof. It is well known that the agriculturists are one of the worst sufferers. In this paper an attempt is made to place the average cultivator in a clearer prospective with reference to his efforts to balance his budget. Statements of actual income and expenditure of some typical average ryots, both proprietors and tenants of the garden and dry tracts of this district, are given in detail to show the precarious position in which they are placed. The difficulties of the tenants and their future are discussed at length A strong plea is made for the quickening of the pace of the establishment of Land Mortgage Banks besides other suggestions for the improvement of the lot of the lowly ryots

12. "THE PLACE OF ECONOMICS IN AGRICULTURE" by T. Narayana Rao.

The present depression has brought into prominence the economic aspects of agriculture, which have been neglected for a long time. The economics of agriculture require a special study because agriculture differs in important respects from manufacture. Agricultural production depends largely on factors over which man has very little control and hence the farmer cannot easily control the supply and the price. This dependence on nature has fostered in the Indian peasant an indifference to the economic environment. But agriculture is India's largest industry and its economic aspects deserve a careful study. All agricultural improvements are only means to an end. The progress and prosperity of the rural community has ultimately to be reckoned in economic terms Many agricultural problems, like marketing, rural indebtedness, fractionalisation of holdings etc., are mainly of an economic nature. Any economic readjustment ought to be based on a thorough study of rural economic organisation. The Punjab Economic Enquiry Board and other bodies are collecting valuable information regarding the economic life in the villages. Such enquiries are useful to the State in planning its agricultural policy and schemes of agricultural improvement. But if any policy is to bear fruit the indifference of the ryot has to be overcome and he should be persuaded to co-operate with the rural economist and the agricultural scientist in improving rural agriculture.

13. "SCOPE FOR ENTOMOLOGICAL WORK IN THE DISTRICTS" by P. S. Krishnamurthi.

Insect control is an important problem in every tract. To increase the usefulness of the department in this line of work by making the Enotomologist's services within easy reach of the ryots a system of decentralisation of Entomological work at Coimbatore was adopted by which assistants have been posted in various parts of the presidency at suitable centres. This enables the easy solution of local problems of which there are very many and depend mostly on environments.

By bringing to the ryots control measures against insect pests which have stood the test at the Central Research Institute, the Entomologist in the district connects the problems in the district with those at Coimbatore. These remedial measures can be classified into Mechanical, Insecticidal and Biological methods. It is found that the ryot does not readily take up to these in the beginning. He treats the mechanical methods with indifference and he cannot afford the purchase of a sprayer or insecticides.' As regards the biological methods it will take a long time to introduce them.

These control measures in general have to be modified to suit local conditions and hence their trial at the various Agriculture Research Stations are essential. At present the facilities for such trials are necessarily limited. However, in course of time with increased facilities it may be possible to expand the scope for Entomological work and help the ryots to a greater extent.

14. "THE PRESENT POSITION OF THE RED HAIRY CATERPILLAR, THE MAJOR INSECT PEST OF SOUTH INDIA" by Dr. T. V. Ramakrishna Ayyar & K. Brahmachari.

The Red Hairy caterpillar (*Amsacta albistriga M.*) may be considered as the most serious insect pest in S. India; it has been noted since the early days of the Madras Agricultural Department long before any other pest came into prominence and has attracted considerable attention since then. Few other crop pests have such a remarkable life history as the hairy caterpillar. In its sudden appearance and disappearance and the devastation it deals, it can be compared to none but the invasions of locust plagues. It occurs in all dry tracts of the Presidency and feeds on practically every green vegetation. Though it is specially destructive to groundnuts and some dry cereals like cholam, cumbu, etc., the loss due to this pest may be estimated generally at 25—40% and in serious cases it goes up to 100% of the crop. Recently it has also had the honour of becoming the subject of a Government legislation in the shape of a Pest Act, which has made it possible to secure the co-operation of the ryots in combating this pest. In this paper the authors have attempted to give a brief review of the bionomics of this insect, its present status, the control methods adopted during the past many years and some suggestions for the future.

15. "SOME IMPORTANT ASPECTS OF DRY FARMING" by Dr. T. R. Seshadiri.

The system of agriculture developed with a view to get the maximum benefit out of a low rainfall is called dry farming. There are two aspects of the problem, the soil and the crop. The amount of moisture utilised depends upon the amount and distribution of the rainfall and upon the physical properties of the soil, its depth and situation. The merits of the different methods of cultivation such as deep tillage, surface cultivation, bunding, summer fallow etc, are discussed. As equally important as suitable tillage are crop adaptations which aim at evolving new varieties capable of either withstanding or evading drought. There is a limit to success in dry farming and this is set by the climate. Intensive studies of the rate of the use of water have indicated methods of predicting the possibilities of crop production under particular conditions of soil and climate.

Notes and Comments.

The Agricultural College Day and Conference: Readers will find published in this issue a summary account of the various proceedings connected with the College Day and Conference which were held in Coimbatore during the latter part of October. Though this annual function was unusually delayed for unavoidable causes it was unique in two respects; firstly due to the fact that the Union was fortunate enough in getting such a distinguished personage as Dewan Bahadur Sir T. Vijiaraghavachariar, K. B. E., the Vice Chairman of the Imperial Council of Agricultural Research to preside over the deliberations of the Conference, and secondly because it happened to be the last annual conference under the auspices of the Union with Rao Bahadur C. Tadulinga Mudaliar as its President. Though there was no special subject treated as a symposium during the Conference as in the last few years, we had interesting papers on diverse agricultural topics such as agricultural education, rural economics, propaganda work, sugarcane, paddy, insect pests, etc. It was however felt that there was not sufficient discussion as expected on some of the important papers, though unlike as in previous years abstracts, of all the papers on the agenda were printed and distributed before hand. There is no doubt that such periodical gatherings will not only go a great way in affording opportunities for the old boys of the College, departmental members of the Union and non-officials interested in agriculture to meet together, exchange thoughts and get some ideas of research work done at the Central Research Institute, but will also stimulate young men and create in them enthusiasm for further and better scientific work and production of valuable papers for presentation at future gatherings. There was a good sprinkling of departmental officers from the various circles, and we are obliged to the Director of Agriculture for deputing them to attend the College Day Week on duty.

2. **The Banana in South India**: Visitors to the College Day and Conference must have seen the interesting exhibition of South Indian bananas arranged by the Systematic Botany Section of the Institute. There are evidently several kinds of banana grown in different parts of the Presidency as was explained in a paper on the subject read by Mr. Cherian Jacob and that these include some excellent varieties fit for the table as well as for use as cooked vegetable. The *Nendran* of Malabar the *Sirumalai* variety of Madura, the *Chakarakeli* of Northern Circars and the *Pacha Vazaai* of the Coromondel area appear to be some of the finest species of Musa in South India, and, each is found to grow very well and in profusion not only in their native tracts but also in other areas, with some care. Under these circumstances, what is wanted in connection with this subject is, in addition to any special botanical work of survey, selection, breeding or evolving of new varieties, the finding of ways and means of considerably improving the marketing facilities for this commodity. Before we think of competing with the West Indies in the markets of Europe, it is up to us to find markets for South Indian bananas in North Indian cities like Benares, Delhi, Lahore, etc. where we hardly ever get any bananas. A good deal can be done by railway companies in this direction, by running fast vegetable and fruit expresses and reducing the carrying charges for bulk consignments. Incidentally, the departmental officers can also try experiments in keeping qualities of different kinds of bananas and encourage the 'plantain fig' industry, especially in tracts where the crop is grown in a large scale, and where there is not sufficient market for all the produce.

3. **The College Principal**: After several years of very useful service as the President of our Union and the Principal of the Agricultural

College, Rao Bahadur C. Tadulinga Mudaliar, retired from active service on the 23rd. of last month. The Madras Agricultural Students' Union cannot sufficiently express its gratitude for and appreciation of the very valuable and substantial help it has been getting in various ways at the hands of Mr. Mudaliar, and there is no doubt that the Union owes its present position a good deal to the constant sympathy and the special regard it always had from him. Though Mr. Mudaliar was recipient of several farewell parties from all of us in different capacities, we take this opportunity of expressing the very best regards of the Union and of offering him our sincere good wishes on the eve of his retirement for well-earned rest, good health and a long lease of life. We have pleasure in publishing in this issue a short biography and a photograph of Mr. Mudaliar.

Birth Day Honours for an old member of the Union : Readers of our Journal and departmental friends will be very happy to learn that Mr. Allan Carruth, Retired Deputy Director of Agriculture, Livestock, Madras, has been honoured with an O. B. E in the Birth Day Honour's list. Mr. Carruth after retirement from Madras has been taking enormous interest in agriculture and has been a member of the Milk Board in Scotland under the Scottish Ministry of Agriculture. That he has been very active even after retirement and that his services to the cuase of agriculture have been recognised is a source of intense gratification and pride to one and all of us. Mr. Carruth has been one of the few members who have been continuing their touch with the Union even after retirement and evincing sympathetic interest in its growth and progress through the advance of the years. Elsewhere in the issue is published a message received from him on the occasion of the College Day and Conference. How great his love for the Union and his appreciation of the work done by our Journal are, can be gauged by his magnanimous contribution of Rs. 100 towards the funds of the Union. At a time when the finances of the Union are giving us considerable anxiety and our appeals are but meeting with indifferent response in these hard times, this voluntary donation from one of our old members, is a very great source of encouragement to us in our endeavours. We have great pleasure in announcing that the Managing Committee has unanimously resolved to make Mr. Carruth, a Patron of our Union.

ABSTRACTS

The Vitamin Content of the Mango Fruit by M. E. F. Crawford and E. O. V. Perey—(*Biochemical Jour.* Vol. XXVII. No 4—pp. 1290). The paper describes details of experiments, by which the observations of Perry and Zilva, in a previous communication on the vitam in contents of these varieties of mango, *Alphonoso*, *Cowasji Patel* and *Shendrya* have been further studied. The analytical data showed that the range of acidity (as H_2SO_4) was from 0·11 to 0·37% and of sugar content (as glucose) from (13·84 to 20·26%). It had been noticed that in an earlier batch received in 1931, the mangoes which were less ripe than these used in the present experiment, that the acid was higher 1·06 to 3·74 % and the sugar less trace to 8·05.

The results of the biological tests showed that as regards vitamins A. & C., Alphonoso showed greater activity that the other varieties. almost complete protection being obtained in the tests for vitamin C, by a dose of 0·5 gm. of the fruit. M. R. B.

Investigations on the Nutritive Values of Indian Food-Stuffs—Part I by A. R. Ghosh and B. C. Guha (*Ind. Jour. Med. Res.* Vol. XXI. No. 2. October 1933). The paper is the first of a series, that promise to be a very important contribution to the existing knowledge on the nutritive value of Indian food-stuffs. The several investigations will be on lines to elucidate the protein contents, the vitamin B1 & B2 values, as well as the contents of calcium, phosphorus and iron—the most nutritionally significant among the inorganic elements. The foodstuffs tested are those in common use in Bengal, but are not unknown to people in other parts of the country. The authors find that *Amaranthus sp., Erythroea roxburghii, Ipomea reptans* and *Spinach oleracea,* in the order named, are the richest sources of iron, and cabbage the richest in lime. A common impression that the *Hibiscus esculentus* is rich in phosphorus, is borne out, other foodstuffs rich in this constituent being *Amaranthus sps.,* and *Bassela cordifolia,* the latter being even richer than *Hibiscus.* As regards protein content, *Spinach, Erythroea* and *Tricosanthus dioica,* easily score followed closely by *Hibiscus.* Vitamin B1 is richest in *Bassela, Spinach, Hibiscus,* and Cabbage, and B2 in Spinach. *Musa* among the foodstuffs examined, seems to be the poorest in every way. A highly nutritional diet, can, we can infer, be attained by the inclusion in the diet of cabbage, *Hibiscus, Amaranthus* and *Spinach,* vegetables which are fairly within reach of the majority of the population. M. R. B.

Experimental work in Relation to Pine apples. By G. D. P. Olds and J. H. Dennett. (Malayan. Agri. Journal Vol. XXI, No. 10 October 1933, Page 492).......... The article is a short report of the experimental work carried out for the past three years on Pine apple at Lim Chu Kang Experimental Station, Malaya. The experiments were three fold, manurial, cultural, and a combined planting distance and manurial treatment. The manurial experiments consisted of six repetitions with twelve treatments, in which figured a no-manure plot and plots manured with the following, singly, in combination and in varying doses:—Lime Sulphate of Ammonia, Sulphate of Potash, Superphosphate, Magnesium Sulphate, Rotted Pine apple refuse and Cattle Manure. The conclusions from the manurial experiment show that (1) the highest yield is obtained from a dressing of 100 lbs. of Sulphate of Ammonia, 300 lbs. of Superphosphate and 200 lbs. of Sulphate of Potash. (2) that there is a definite response to phosphates (3) that liming alone has no beneficial effect on the number of fruits, although it may increase the weight of each fruit, and (4) that fertilisers containing phosphates give early maturity.

The results of the cultural experiments which consisted of the following treatments: (1) Mulched with PABCO Thermogen paper, (2) forked once annually, (3) clean weeded, (4) mulched with pine apple refuse and (5) unweeded, show that the PABCO treatment yielded best, although the yield even here. was by no means comparable to yields obtained by the most suitable manurial treatment. The indications of the experiment so far appear to be, that it is more profitable to increase yield of this crop by suitable manure-mixtures than by cultural treatment alone although a judicious combination of both will certainly result in a more economic return.

A green manure experiment, in which the effect is tried of the following green manures is also in progress, but the results are not yet ready for interpretation; (*1*) *Crotolaria amagryroides* (*2*) *Tephrosia condida*, (*3*) *Mimosa invisa* (4) Groundnuts.

In view of the increasing recognition of the importance of fruits in diet, fruit culture is becoming more popular with our farmers; but only in a few localities like the Simhachalam Hills of Vizagapatam, and parts of the west coast and the Palni Hills, is the pine apple being cultivated at present in our Presidency, and as such, we are not yet in a position to lay out any extensive experiments on the crop. We therefore await eagerly, further information from the results in future years of these very interesting experiments on Pine apple in Malaya

M. R. B.

The Hoffer Method of Detecting Potash Deficiency in Soils. E. I. Alexeeva, in Naukovi Zapiski, Vol. 19 (1933), Book 29/30, pp. 65—71. The Hoffer method for recognising potash deficiency in soils is based on the assumption that where there is a deficiency of potash there will be an accumulation of iron in the nodes of corn stalks. In such cases, if the stalk is split and the region of the node is moistened with a solution of potassium sulphocyanate, a reddish color will be observed. The author has made an extensive series of tests with this method and finds that it is of diagnostic value only in cases of soils extremely poor in potash. (*Facts about Sugar*, Vol. 28 No. 10).

Comparative Growth-Promoting Value of Various Protein Foods. In spite of the amount of research that has been carried out on this subject it is not yet possible to assign a definite characteristic co-efficient to each of the protein feeds. F. Ferrini and Simone Valla have taken up the question with a view to obtaining accurate information regarding the quality of the proteins contained in each foodstuff Young pigs weighing about 15 kg were used for the experiments and 18 different feeds. The test covered 5 periods of about a week, during which the rations contained always the same amount of nitrogen and were rich in glucides (150 calories approximately) ,salts and vitamins. The periods differed only in the nature of the nitrogen-containing elements: skim ,milk in the first and third periods and one of the substances under study in the second. Calculations were made of :— (1) the coefficient of digestibility (N absorbed/N ingested X 100)—(2) co-efficient of retention (N retained/N absorbed X 100)—(3) coefficient of practical utilisation (N retained/N ingested X 100). The results obtained, expressed in tabular form, make it possible to draw a number of conclusions, the chief of which are as follows :—(1) The purchase and use of a protein feed for livestock must be based on the proportion of proteins that the organism is capable of utilising for the renewal of its tissues. The utilisation of nitrogen may vary in the ration of 1 to 3. (2) A mixture of skim milk and starch (e. g. cassava) supplemented by the necessary mineral substances and vitamins constitutes the optimum growing ration. (3) Among protein feeds, the total albumins of milk and casein give the best results. Among the cereals, barley shows a marked superiority; wheat is mediocre. The proteins of wholemeal wheat flour (Graham meal) were found greatly superior to those of more refined flours. The lower digestibility of Graham flour in comparison with refined flour, which is due to its higher content in inert substances, is far from counterbalancing the advantages conferred by the better utilisation of its proteins in the metabolism of the animal. The luxury flours have the lowest nutritive value. (4) The proteins of the Leguminoseae, as those of the cereals, show marked variations in the co-efficients of utilisation and retention of the nitrogen. Those that are worthy of consideration are soya bean and groundnut meals, the proteins of which have an equal growth-promoting value to those of wholemeal flour. (Abstracted by G. S in the *International Review of Agriculture*, Vol. XXIV, No. 9. pp. 395 T).

Gleanings.

A note on cotton of which the Farmer Dacca muslins were made, by *S. R. Deshpande, (T. U. of Bombay* 1—4—33 P. 401) Documentary evidence regarding the famous Dacca cotton is mostly contained in the East India Company's Papers. The first Dacca cotton was grown in a small area of about 40 miles in length by less than 3 miles in breadth along the banks of the Megna, about 20 miles from the sea. It was used mainly for the manufacture of the muslin and was never exported. The cotton finaly disappeared, mainly because of deterioration caused by bad handling, picking, and misusing. Reported as a note in *Empire Cotton growing Review*, October 1933 Vol. X. No. 4. P 302.

White Hide. The Alum Tanning Process. (1) Soak the hide in clean water for four hours, then run off the dirty water and cover with clean water; leave for twenty-four hours. This should be sufficient for fresh or salted hides. Dry hides should be soaked for a further twenty-four hours, or until they are soft. (2) Remove the hair by soaking hides in milk of lime—30 lb. lime per 100 gallons water. Handle each day, and leave until the hair can be removed—about six to seven days in summer. (3) Remove all flesh and fat by scraping with a knife. Wash well with several lots of water during the twenty-four hours after removing the hair and pieces of flesh, fat, etc. (4) Tan in a solution of alum (5 lb.), salt (1½ lb.), Glauber salt (1½ lb.), and water (10 gallons). Use enough of the solution to cover the hides. Handle twice daily and allow six days for tanning. (5) Drain well from the alum and salt solution, but do not wash; then cover both sides with fish oil or neatsfoot oil, and hang up and allow to dry slowly. Tanners have a machine for forcing the oil fats, etc., into the hide. (6) When dry, stretch until soft. If dry skins are difficult to stretch, sprinkle with water and cover for two days; again stretch and dry.

Alum-tanned leather is sometimes covered with a paste instead of oil before drying. The paste is made up as follows:— 5 lb. flour, 2½ lb. alum, 1 lb. salt, 1 lb. neatsfoot oil, 1 to 1½ gallons water. Mix the alum and salt with water and then the flour and oil in a separate basin. Add to the flour and oil sufficient of the alum and salt solution to make a paste. Put the hide and paste into a tub, and handle the hide vigorously so as to force the paste into the leather. Hang the leather up and allow it to dry slowly without removing the paste. If the leather is too firm, rub on more fat, such as soft dripping, etc. If possible, stretch the leather just before it is quite dry. After stretching, it can be nailed on a wall or similar surface. *(Agricultural Gazette of N. S. W, October 1, 1933).*

Oil from Seeds of Indian Figs. The fruit of *Opuntia Ficus-indica* contains about 36% of rind, 61% of pulp and 3 to 4% of seeds; the seeds contain 8 to 10% of a semi-siccative oil with a specific weight of 0·929, saponification index of 189 and iodine index of 116. The oil may be extracted as in the case of other seed oils such as tomato, for example, by submitting the pulp to a continuous pressure (Egrot and Etrange, Olier, etc presses) or by using various solvents (trieline etc). Where the collection of a considerable quantity of seeds, as a waste product of the industrial treatment of the fruit, is possible, refined Opuntia oil may be successfully used, after boiling in the presence of catalysts (resinate of lead, cobalt, etc.), for the preparation of good quality varnish. Further, the possibility of destearinating the oil and removing the linoleate by freezing would make the oil suitable for a number of other uses, including food. Voltolysed and hydrogenated Opuntia oil will form a good lubricant when mixed with other mineral and vegetable oils (palm oil, olive oil, castor oil etc.). *(International Review of Agriculture, September 1933).*

A Few Hints on Sharpening a Steel Ploughshare. Build a fire on the forge suitable for this particular work. This is done by banking the fire, allowing only a small opening in the side for the blaze and heat to escape. Commence with the point of the share. Insert this into the fire just far enough to heat the part you wish to draw, never permitting the heat to extend farther back on the share than is absolutely necessary. Draw this down to the proper shape and thickness, which should be as near the original level as possible. After the point has been finished, work back toward the heel or wing of the share, never heating more than 1½ inches from the edge and 2½ inches wide. It is important to keep hammering after the steel has changed from a red to a black heat. as this makes the edge tough and hard, giving a wearing surface that will last much longer. If once down the share is not sufficient, reheat; but confine the heated part to the foregoing measurements. In working along the cutting edge, keep it straight. In so doing you will avoid having to go back and reset the edge. After a *solid steel share* has been set as instructed, it should be reheated to a cherry-red and left to cool in the air; *it should never be submerged in water or oil.* (*Agricultural Gazette of N. S. W. October 1, 1933*).

Rao Bahadur C. Tadulingam Mudaliar, F. L. S.,

Retired Principal, Agricultural College.

Mr. Chinnakavanam Tadulingam, Principal. Agricultural College, Coimbatore, was born in October 1878. He comes of an ancient, respectable and influential Mudaliar family of Madras. Born in the Vellala community which is pre-eminently an agricultural community and bred up in an agricultural atmosphere he rightly entered and has been serving in the Agricultural Department for over 32 years. He had his education in the Hindu High School, Triplicane, and in the Presidency College, Madras. He is a student of the eminent Biologist Dr. (now) Sir Alfred Bourne, F. R. S. and in the B. A. Degree Examination held in December 1900 took the first place in Botany.

He was selected by the late Mr. C. A. Barber, C. I. E., the then Government Botanist and put in charge of the Madras Herbarium of which Dr. Barber was the Head. Mr. Tadulingam joined his appointment in Ootacamund in April 1901. The Herbarium was shifted to Madras in June 1902 and from there again to Coimbatore in June 1909 and Mr. Tadulingam's scene of activities likewise changed, first to Madras and later to Coimbatore. He has therefore been in Coimbatore for about twenty four years. From 1910 he was also teaching Botany at the Agricultural College.

During the earlier years of his service, when the Herbarium was attached to the Botanical Survey of India, he explored the various floristic regions of the Madras Presidency from Ganjam to Cape Comorin. In this connection he ransacked the forests of Travancore and very largely added to the botanical collections which have formed the basis of the Classical Kew Publication, Gamble's Madras Flora. In the course of his study of weeds and fodder grasses of Southern India he discovered several species new to science and has described them in well known Botanical Journals. Being one of the earlier workers in the investigation of spike disease in Sandal-wood, he made special studies of its root parasitism in the sandal zones of Mysore and in doing so made some interesting finds in the family Olacaceae which showed similar characteristics.

He gave a paper on " Madras Flora " to the Indian Science Congress for its Madras Session in 1915. " A new Species of Senecio " was the subject of another contribution of his to the Science Congress which met again in Madras in 1926. He has also been responsible for several publications of botanical interest and is the joint author of " A Hand book of Some South Indian Grasses " (1921) and of " A Hand Book of Some South Indian Weeds " (1932) which have been very well received by botanists of world reputation in England.

Mr. Tadulingam was made a Gazetted Officer in 1918 with the designation of the Assistant Lecturing and Systematic Botanist and in his capacity of Assistant Principal—which additional duties also he was discharging at frequent intervals during the years 1920, 1921 and 1922, —he gained experience as an administrative officer. He was promoted to and confirmed in the Indian Agricultural Service in 1923 as Lecturing and Systematic Botanist.

He is the first wholetime Principal of the Agricultural College, having been appointed to that post in May 1927 when the new Reorganization Scheme was given effect to. Being put in entire charge of teaching and in sole control over the Central Farm, the Botanical Garden and the College Estate and over the Centralized Office he has had to do a lot of spade work with tact and patience and the success which attended his efforts at the end of the very first year of his tenure of office as Principal was so very striking that the Head of the Department wrote in his Administration Report that the " Principal (Mr. Tadulingam) is to be congratulated on the way in which he has carried out all these changes (brought about by the Re-organization Scheme) without a hitch and on the smooth running of the College and the Estate. Though he has a Vice Principal to help him, he has undoubtedly been hard-pressed more especially as he has doubled his duties with those of the Systematic Botanist."

Other lines of activities have also found in him a zealous and willing worker and warm supporter. He was Honorary Warden of the Agricultural College Students' Hostel for three successive years. He was the Secretary of the Madras Agricultural Students' Union for two terms, Vice President for six terms and has been President with one interval since 1927. It was during his Secretaryship the financial foundations of the Union were laid strong and deep and stability secured. He is the elected President of the Officers' Club at the Agricultural College and has held that position on seven occasions since

1920. He is the President of the Lawley Road Public Servants' Co-operative Society. He has been one of the Vice Presidents of the Indian Officers' Association, Madras, for several years. He has been a fellow of the Linnean Society of London since 1915. He is a member of several University authorities of the Madras and Andhra Universities and Chairman of the Board of Studies and of Examiners in Agriculture, Madras University. He is a member of the Annamalai University Committee for selection of students for post-graduate course at the Imperial Agricultural Institute, Pusa. For a second time the Inter-University Board of India has elected him as its representative on the Advisory Board of the Imperial Council of Agricultural Research. The Andhra University appointed him as the Commissioner to inspect the Rajah's College, Parlakimedi and report on its suitability for affiliation to the University in Agriculture in the Intermediate Examination. He was one of the members of the Committee which in 1929 examined the conditions necessary for securing an Agricultural bias in boys in rural schools. He has just finished his labours as one of the two members of the Bombay University Inspection Committee of the Agricultural College, Poona. Having been a keen Cricketeer in his earlier age, he has maintained his love and enthusiasm for sports and games and has been a prominent figure in all the sports activities in this town, and has donated a cup to be competed for in an Inter Tutorial—Cricket Tournament at the College. He has been taking an abiding interest in the Scout Movement since its inception. He is a Freemason. He was worshipful Master of Lodge Ampthill of Coimbatore in 1922. By temperament and training a pious man Mr. Tadulingam has been the Trustee of a very ancient Ganesa Temple in Triplicane since 1914.

By dint of merit, honest and industrious work, intense loyalty and uprightness both in Government Service and in his unofficial capacity extending over 32 years, Mr. Tadulingam has risen to the high position which he occupies to-day. Government recognised his services with the award of a ' Rao Bahadur ' in the New Year Honours List, in 1933.

What exactly is the secret of the success which so markedly characterised every one of Mr. Mudaliar's innumerable activities—official and unofficial—during his long period of service in the Department? Geniality of temperament, easy accessibility to high and low, extreme tact in handling delicate situations, and a cheerful encouraging smile to all and sundry—these have been the traits of Mr. Tadulingam. If the " art of gentle persuasion " could be imagined to be personified, then that person is certainly Mr. Tadulingam. His is, indeed a remarkable personality; not the personality that awes and subdues, but a magnetic one that cheers and wins. The feelings that he engendered in the hearts of his colleagues, subordinates and students on his inevitable retirement, may well be gauged, from the following incident on the platform, when on the eve of his departure to Madras, an unprecedentedly large crowd had gathered at the Railway Station to bid him farewell. The Blue Mountain Express was a few minutes late that day, and some students were overheard to remark, how they wished the train could be delayed till March 1934, so that they could still have their beloved Principal with them, at least till then!

He has retired from active service in the Department, but we who have moved with him know only too well that his active, helpful temperament will not allow him to sit idle. The scene of his labours will get changed, the sphere of his activities, will become wider still, and in this new life, more successes will crown his efforts, and greater honours will be showered on him while he with his dignified yet simple and cheerful smile, will shed love and happiness far and around. May God bless him with many more years of health and cheerful service!

College News & Notes.

Games. *A return visit.* The Salem United Club paid a return visit to us and were here as our guests for two days on the 4th and 5th November. The club played a series of matches in tennis, cricket and football with us on the 5th. In tennis our College played a number of matches but sustained defeat due to the superior talent and calm game of our opponents, though Moncey Joseph our local champion put up a good fight in his singles match with Varadarajan and lost narrowly. In cricket we took the field without two of our regulars, Albuquerque and Thomas who were unavoidably absent. Batting first we scored 74 of which Ramanatha Rao made 31 and Ananda 23. The club in their turn passed our total losing only 5 wickets. Continuing they had made 98 runs for the loss of 7 wickets when stumps were drawn for the day. Narasinga Rao took 4 wickets and Ramanath Rao 2. The last game with the visitors was in Football and happily we managed to win here at least with a margin of 3 goals to nil. C. Parthasarathy played a brilliant game and scored all the three goals.

Hockey. *The Parnell Cup.* The inter-class hockey Tournament for the Parnell cup provided more than passing interest. In their first match in the first round class iii beat class i by one goal and repeated their success in their encounter with class ii. The match between class ii and class i ended in a pointless draw. In the second round class iii again defeated class i this time by 3 goals. Class i sustained another defeat at the hands of class iii by 3 goals to 1 in their second match with class ii. The match between classes ii and iii was not played because the latter who secured the maximum number of 6 points annexed the cup.

The Coimbatore Hockey Tournament. In this tournament which is on the knock-out system our first match was against the Forest College which came off on the 27th of October. Our college won comfortably by scoring 2 goals against nil and qualified for the finals. In the finals we met Stanes European High School on the 30th of October, and though leading by one goal in the early stages of the game we sustained a heavy defeat scoring only 2 goals as against their 6. Though defeated we have to our credit a well fought game.

Health week Football Tournament Due to some misunderstanding in the arrangement of our first match with the London Mission High School and the unsuitability of other dates fixed we did not find it convenient to participate in the tournament and consequently withdrew.

Tennis. The American handicap Knock-out Doubles tournament has commenced and is now in full swing. The number of entries this year is poor due to the running of the tournament on the Knock-out system which results in the entire elimination of poorer players from the tournament in the early rounds.

Address to Rao Bahadur M. R. Ramaswami Sivan. The students entertained Rao Bahadur M. R. Ramaswami Sivan at a grand dinner and presented an address to him expressing their gratefulness to him for the great help he has rendered and is rendering for the betterment of the students of this College.

The retirement of Rao Bahadur C. Tadulingam Mr. Tadulingam who retired from active service on 23rd October 1933, was the recipient of several tea parties and dinners got up in his honour, on the estate and in Coimbatore Town. The Officers club the Principal s section, the Indian Officers Association (Agricultural Branch), the Fieldmen's Association, the Students club, the Botanical Garden Staff, the Systematic Botany staff, and the District Agricultural Association, Coimbatore, all did honour to him, and it was very kind of him to have stayed on for three days after his retirement and given these several bodies an opportunity to bid him farewell which for several reasons they could not do the previous week. On Friday the 27th, the day he and Mrs. Tadulingam left for Madras, unprecedented scenes were witnessed at the railway station. The student population and many friends of Mr. Mudaliar in the estate and the town were present, and Mr. and Mrs. Mudaliar took leave of every one individually. The students particularly had mustered strong and lining up in two rows, enabled Mr. and Mrs. Mudaliar to pass with garlands on, along the rows, affording every one to pay his respects and give his good wishes to them. Even as the train was steaming out of the station, cheers were being proposed and responded to enthusiastically and several officers even accompanied Mr. and Mrs. Mudaliar as far as Podanur.

Sugar Committee. By becoming the venu of the Sugar Committee of the Imperial Council of Agricultural Reseach, which met at the Imperial Sugar-cane Breeding Station, Coimbatore, from the 14th to 17th November 1933, the station and the estate were quite active during the three days, with meetings, parties and lectures. Sir T. Vijayaraghavachariar attended, as President, the Committee meeting. Rao Bahadur T S. Venkataraman, Sugarcane Expert. Mr S. Sundraraman, Principal in-charge, and the Indian Officers Association (Agricultural section) were 'At Home', to the Sugar Committee on the evenings of the 14th and 15th and 16th respectively.

During the Sugar Committee's visit, films taken by the department, featuring departmental activities, like students at practical work, the working of implements, like the discplough, the College Dairy, the sugarcane crop at Anakapalle, and cream jaggery manufacture. were shown to the visitors in cinema show. Some of the pictures, especially those relating to cream jaggerya were good and appreciated by the Director of Agriculture and others.

Change in Principalship. Pending the arrival of Rao Bahadur D Ananda Rao, Principal designate at the end of the month Mr. S. Sundararaman. the Government Mycologist is holding charge of the office in addition to his own duties.

The Upper Subordinates Association. The Annual tea and General body meeting of the Association was held on Sunday the 22 October 1933, with Mr. S. N. Chandrasekharan, M. A. in the chair. After reading and adoption of the Annual report, the following office bearers for 1933—34 were elected. Mr. K. M. Thomas, *President*;

Mr. C. Srikhnaswami, *Secretary*. Messrs S. Narayanaiah, T. Rajagopal Iyangar and A. Chidambaram Pillai, *Committee Members*. A number of important resolutions were discussed and passed.

The Fieldmen Association. At a meeting of the above Association held during October, Mr. S. Sundararaman was elected President of the Association in place of Rao Bahadur C. Tadulingam, who has left the estate, consequent on retirement.

The Association of Economic Biologists. There was another meeting on the 24th November, when Mr. V. Ramanatha Ayyar, and Mr. R. Sankaran presented papers on "The Problem of Selection in Hybrid Progenies" and on "Some Aspects of Drought Resistance with special Reference to cotton". Brief reports of these meetings will be published in a later issue of the journal.

Advantage was taken of the large number of distinguished visitors attending the Sugar Committee meeting, by the Above Association to arrange for two meetings on 14th and 15th respectively. at the first of which Mr. B. C. Burt, B. Sc. C. I. E., Agricultural Expert to the Imperial Council of Agricultural Research, spoke on *The position of Pulses in Indian Agriculture*" and at the second Mr. D. B. Sethi B. Sc. Director of Agriculture, Bihar, spoke on "Research and Agriculture"

Review.

Soviet Economics. A Symposium edited by Dr. Gerhard Dobbert and translated from the German by Malcolm Campbell, John Lane, The Bodley Head Ltd., London. Price 4 s.

As stated above this book is a Symposium of 14 articles on practically all aspects of Soviet Economics, contributed by various authors including professors and journalists who have lived in Soviet Russia for several years. Being foreigners these authors have given very clear and impartial observations on the different aspects of the economic life of the people under the new regime of the Union of Socialist Soviet Republic. Soviet Russia has indeed attained a very great post-war prominence. The world is now taking the keenest interest, in the working of the Soviet republic in that it has revolutionised society and launched upon schemes of unparallelled magnitude and far reaching effect. The essays given in this book include those on planned economy, organisation of economic life, captains of Soviet industry, agriculture, finance, transportation, trade, social problems and foreign assistance. The editor of the publication promises more books of this sort and they are certainly welcome.

A perusal of this book gives us a clear idea of the conditions prevailing in the country before the war and the unsettled conditions that prevailed after the war and how Lenin and his compatriots brought about order out of chaos making it possible the inauguration of the communistic domination and the planned economic revival about which we have been hearing so much of late. The second Five-year Plan dating from January 1st, 1933. looks forward to "The final liquidation of capitalist elements and of classes in general, the complete destruction of the causes which give birth to class differences and exploitation and the overcoming of the survivals of capitalism in economics and in the consciousness of the people the transformation of the whole toiling population of the country into conscious and active builders of socialism. '

, The defects and the negative effects of the Five-Year Plan have also been effectively brought out, in this book. The cost of. production has become very high and owing to defective and undeveloped transportation system and due to over-anxiety for large export, there has not been enough food for the people in the country for several years. "The State apparatus is still too cumbersome and too expensive; year in year out the printing presses turn out mountains of verbose decrees, instructions etc." "Moscow strikes the foreign visitor as being a city composed entirely of office buildings." The achievements have however been great with unexpectedly favourable results. The collectivisation of farms for agriculture has progressed and there are more than 3000 machine tractor stations each having more than 100 tractors. In July 1931 there were 121 research institutes employing 27000 research workers. In the words of a Russian we can sum up the progress of Soviet economic organisation as follows:—We are going ahead fast enough, but we are racing along a dark road with blinded head-lights." The book affords interesting as well as instructive reading. S. V. D.

Crop & Trade Reports.

Statistics—Paddy Crop 1933-'34. *First Report.* The average of the areas under paddy in the Madras Presidency during the five years ending 1931—32, has represented 13·3 per cent. of the total area under paddy in India. 2. The area sown with paddy up to the 25th. September 1933 is estimated at 7,479,000 acres. When compared with the area of 7,618,000 acres estimated for the corresponding period of last year, it reveals a decrease of 1·8 per cent. 3. The decrease occurs mostly in the Circars (Ganjam and Vizagapatam excepted), Chingleput (—110,000 acres) Chittoor, North Arcot and Ramnad. The reduction in Chingleput may be attributed to insufficient rains at sowing time. 4. First crop paddy is being harvested in parts of Coimbatore, Trichinopoly and the South and on the West Coast. The yield is expected to be normal except in parts of Tinnevelly where the crop was adversely affected by rains. The condition of the standing crop is satisfactory except in parts of the Carnatic where the crop was affected by drought to some extent. 5. The wholesale price of paddy per imperial maund of 82 2/7 lb. as reported from important markets towards the close of September was Rs. 2—10—0 in Kurnool, Rs. 2—5—0 in North Arcot, Rs. 2—3—0 in Cuddapah, Nellore and South Kanara, Rs. 2—2—0 in Salem and Madura and ranged from Rs. 1—8—0 to Rs. 2 in the other districts.

Intermediate monthly report. The harvest of first crop paddy has either concluded or is concluding in Trichinopoly, the South and the West coast. The yield has been reported to be normal in Tanjore and in the other districts slightly below normal due to heavy rains at harvest time.

The condition of the standing crop is satisfactory in most of the districts. In parts of the districts of East Godavari, West Godavari and Kistna, the crop is reported to have been affected to some extent by floods. In parts of the Carnatic, Chittoor and North Arcot the early sown crops were affected by drought to some extent.

2. The wholesale price of paddy per imperial maund of 82 2/7 lb. as reported from important markets towards the close of October was Rs. 2—10—0 in Kurnool, Rs. 2—3—0 in Cuddapah Rs. 2—2—0 in Nellore and ranged from Re. 1—6—0 to Rs. 2 in the other districts. When compared with the prices reported for September 1933, these prices are stationary in Kistna, Guntur, the Deccan, Trichinopoly, Tinnevelly and Malabar. They are lower by 19 per cent. in Madura, 13 per cent. in North Arcot, 9 per cent. in South Kanara and 3 to 6 per cent. in most of the other districts.

Sugarcane Crop. *Second Report.* The average of the areas under sugarcane in the Madras Presidency during the five years ending 1931—'32, has represented 3·6 per cent. of the total area under sugarcane in India. 2. The area planted with sugarcane up to the 25th. September 1933 is estimated at 113,500 acres. When compared with the area of 117,100 acres estimated for the corresponding period of last year, it reveals a decrease of 3 per cent. 3. The decrease occurs in all districts outside the Circars, Bellary, Chingleput, Tanjore and the West Coast and may be attributed to low prices for jaggery. The decrease has been marked in South Arcot, North Arcot and Trichinopoly. In the Circars the area rose by about 10 per cent. from 45,390 acres to 49,800 acres due chiefly to the impetus given by the prospect of the opening of sugar factories. 4. The condition of the crop is satisfactory except in South Arcot where it is reported to have suffered from stem-borer to some extent. If the season continues to be normal in the remaining portion of the growing period, the yield is estimated at 322,260 tons of jaggery against 330,860 tons for the corresponding ,period of last year. 5. The wholesale price of jaggery per imperial maund of 82 2/7 lb. towards the close of September was Rs. 5—2—0 in Erode (Coimbatore), Rs. 4—6—0 in Bezwada and Rs. 3—6—0 in Vizagapatam. It ranged from Rs. 3—10—0 to Rs. 4 in the other important districts.

Statistics—Groundnut Crop. *Third Report.* The average of the areas under groundnut in the Madras Presidency during the five years ending 1931—'32 has represented 51·5 per cent. of the total area under groundnut in India. The area sown with groundnut up to the 25th. September 1933 is estimated at 3,211,200 acres. When compared with the area of 2,986,500 acres estimated for the corresponding period of last year, it reveals an increase of 7·5 per cent. 3. The increase is general outside Ganjam, Kurnool, Cuddapah, North Arcot and Tanjore and may be attributed to the receipt of timely rains at sowing time. The individual areas in Kistna, Guntur, Bellary and Coimbatore are in excess of the final areas in those districts in any of the previous years. 4. The summer crop throughout and early crops in parts of Coimbatore have been harvested. The yields were normal. 5. The condition of the crop is generally satisfactory. The crop was affected by drought to some extent in Nellore and Salem and suffered from an attack of hairy caterpillar in parts of Ganjam, South Arcot and North Arcot. 6. The wholesale price of groundnut shelled, per imperial maund of 82 2/7 lb. as reported from important markets towards the close of September was Rs. 4—2—0 in South Arcot (Cuddalore), Rs. 3—11—0 in Vizagapatam and Rs. 3 to Rs. 3—5—0 in the other districts. When compared with the prices reported in August 1933, prices have fallen from 6 to 12 per cent.

Statistics—Gingelly Crop. *Second Report* The average of the areas under gingelly in the Madras Presidency during the five years ending 1931—'32, has represented 12·3 per cent. of the total area under gingelly in India. 2. The area sown with gingelly up to the 25th. September 1933 is estimated at 532,200 acres. When compared with the area of 549,500 acres estimated for the corresponding period of last year, it reveals a decrease of 3 per cent. 3. The decrease is general except in the Circars, South Arcot, Coimbatore, Ramnad and Tinnevelly. It is marked in Anantapur, Chingleput and North Arcot. 4. The early crop of gingelly has been harvested in parts. The yield was about normal. The condition of the standing crop is satisfactory except in Anantapur, Chingleput, South Arcot, Salem and South Kanara. Attacks by insects are reported from Anantapur.

Weather Review (OCTOBER—1933)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st	Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	15·3	+7·5	51·8	South	Negapatam	7·9	−2·5	23·3
	Berhampore *	12·2	+2·2	58·1		Aduthurai *	6·6	−2·4	20·2
	Calingapatam	8·6	+1·9	42·7		Madura	5·9	−0·8	28·8
	Vizagapatam	10·3	+3·3	26·9		Pamban	6·3	−2·7	13·2
	Anakapalli *	9·5	+0·6	44·8		Koilpatti *	8·9	+1·3	19·6
	Samalkota *	6·9	+1·9	31·7		Palamkottah	7·4	+0·7	22·5
	Cocanada	8·3	+0·6	31·1					
	Maruteru *	8·7	−2·7	39·1					
	Masulipatam	9·1	+1·1	37·0	West Coast	Trivandrum	15·1	+4·7	112·9
	Guntur *	3·8	−1·8	24·9		Cochin	10·6	−2·2	148·2
						Pattambi *	14·2	+2·9	136·2
Ceded Dists.	Kurnool	5·4	+2·0	24·0		Calicut	14·9	+5·0	165·1
	Nandyal *	4·4	+0·8	30·0		Taliparamba *	15·3	+4·1	187·0
	Hagari *	2·7	+0·3	24·4		Kasargode *	8·9	0·0	159·4
	Bellary	5·8	+2·2	35·1		Nileshwar *	13·4	+4·3	167·0
	Cuddapah	3·3	−1·6	20·3		Mangalore	13·8	+6·6	158·9
	Anantapur	4·5	...	26·1					
Carnatic	Nellore	20·6	+12·3	33·1					
	Madras	9·8	−1·7	18·9	Mysore and Coorg	Chitaldrug	8·1	+3·9	36·0
	Palakuppam *	6·5	−3·3	25·3		Bangalore	8·1	+2·4	38·9
	Palur *	4·6	+1·5	31·2		Mysore	7·4	+1·2	37·7
	Cuddalore	3·7	−7·0	26·0		Mercara	9·9	+1·4	158·5
Central	Vellore	4·5	−1·6	19·1	Hills.	Kodaikanal	10·7	+1·3	62·5
	Salem	11·0	+4·0	43·1		Coonoor *			
	Coimbatore	7·0	+0·7	24·0		Kallar *			
	Coimbatore Res. Inst. *	9·0	+3·0	26·2		Ootacamund *	10·5	−1·4	58·6
	Trichinopoly	8·5	+1·8	30·6		Nanjanad *	7·2	−0·5	52·3
					Central	Hosur cattle farm *	6·1	+5·7	26·6

* Stations of the Agricultural Dept.

Summary of General Weather Conditions. The favourable indications for the onset of the north-east monsoon which were prevailing during the end of September did not persist long. Till the 13th. the south of Madras experienced very heavy local thundershowers but without the least sign of the approaching monsoon.

In the absence of the monsoon, under the influence of four depressions which developed from time to time after the 12th. both in the Bay of Bengal and the Arabian Sea, the whole of India experienced a fairly well-distributed rainfall with marked excess in places. This unsettled weather conditions prevailed well over a fortnight, this in a more intensified form along the North Madras and the Coromandel Coasts, with local heavy precipitation of rain causing considerable damage to crops and dislocation of railway traffic on account of breaches.

The western disturbance which caused clouds along the North-west Frontier and Kashmir on the 12th. resulted in widespread thunderstorms and recurved eastwards on 15th. after causing dust-storms and showers in Kashmir and the United Provinces. The second one was a shallow depression of sufficient importance which formed in the Bay of Bengal to the South of the Andamans on the 13th. This moved north west-wards and developed into a storm on the 15th.

being centred within 100 miles off Cocanada. The storm crossed the coast on the morning of 18th. between Masulipatam and Cocanada into the interior and was concentrated as a deep depression near Chanda on the 19th. and moved northwards over East Central India and weakened itself into a diffuse low pressure area on the 22nd. over North Bengal and Assam.

This Bay storm has caused widespread rains of great intensity in its course mostly along the Coastal regions of Bengal, Orissa aud Northern Circars. When this depression was active along the East Coast a third one of mild intensity developed in the East Arabian Sea on the 16th. with its centre near Lat. 13° N. Long. 69° E. and disappeared as a feeble and unimportant disturbance. E × A bull in the weather conditions prevailed from 23rd. to 27th. with the exception of a few local thunderstorms in parts of Madras, Mysore and Deccan ×. The last one for the month was another Western disturbance which passed away through Kashmir on the 26th. affecting the weather in the extreme north with a few falls in its course. The last days of the month were marked by unusually heavy rainfall in places along the Coromandel Coast.

The total rainfall for the month was in large excess in Malabar and North Madras Coasts and in slight excess in Mysore and in defect in parts of South-east Madras.

During the month, the humidity was in excess all over the Presidency with a slight deficiency in places for a few days when dry weather conditions prevailed. The maximum and minimum temperatures were below normal.

The heavy falls reported were :— Trivandrum 3·9'' (3rd), Pechipara (Travancore) 8·6'' (4th.), Cocanada 4·3'' (17th), Gopalpore 4·1'' (19th.), Nellore 8·1'' (29th.), Madras 5·4'' (29th.) and Palamcottah 4·6'' (30th.)

Weather Report for the Research Institute Observatory :

Report No. 10/'33.

Absolute maximum in shade	88·5°
Absolute minimum in shade	62·5°
Mean maximum in shade	84·7°
Mean minimum in shade	69·7°
Total rainfall	9·03''
Departure from normal	+ 3·06''
No. of rainy days	16
Heaviest fall in 24 hrs.	2·52''
Mean daily wind velocity	2·5 M. P. H.
Mean 8 hrs. wind velocity	3·0 M. P. H.
Mean humidity at 8 hrs.	85·5 %
Total hours of bright sunshine	198 hours
Mean daily hours of bright sunshine	6·4 hours

Summary of Weather Conditions : The prevailing pressure was fluctuating considerably, indicative of the North-east Monsoon type of weather. There were numerous thundershowers, the heaviest fall being 2·52'' on the 4th. The rainfall was above normal and the humidity in excess. The absolute maximum and minimum tures were below normal. The minimum temperature of 62·5° recorded it be considered to be quite unusual for this part of the year. Days were moderate and nights chill.

C. V. R. & T. S. L.

Departmental Notifications.

I Cricle. N. Ramadoss, A. D. Cocanada, l. a. p. for one month from 5—11—33. **II Circle.** J. Suryanarayana A. D. Vinukonda. l.a. p. for one month from 15—10—33. T. Narayana Rao M. A. Millet Assistant, Guntur l. a. p. for 9 days from 9—10—33. The period of leave availed by T. Paramanandam, F. M. A. R. S. Guntur, from 2—10—33 to 11—10—33 treated as l. a. p. Extension of l. a. p. till the end of the month, **III. Circle.** V. Panduranga Rao Assistant, Hagari, l. a. p. for 17 days from 18—10—33. A. Krishnaswami Iyer, A. D. Koilkuntla, l. a. p. for one month from 18—10—33. K. V. Seshagiri Rao, A. A. D. Allagada, l a. p. on M. C. for 4 months from date of handing over charge. **IV Circle.** T. K. Mukundan F. M. Palur, transferred to Tiruvannamalai to start work in that Taluk. in groundnut marketing. **V Circle,** A. Yesudasan A D. on Van duty l. a. p. for one month from 21—10—33. **VI Circle.** K. Ramaswami Iyer A. D. extension of l. a. p. till 21—12—33 in continuation of leave already granted. **VII Circle.** E. Achuthan Nair, A. A. D. Tellicherry, l. a. p. for 4 days from 4th to 7th October 1933, **VIII Circle.** T. K. Thangavelu, A. D. Gobichettipalayam, l. a. p. for 18 days from 2—10—33. K. G. S. Bhandari A. D. Ootacamund, l. a. p. for 12 days from 9th to 20th October 1933. K. Sivasankara Menon, A. D. Dharmapuri, extension of l. a. p. for 15 days in continuation of leave already granted. K. H. Subrahmania Iyer A. D. Palladam, l. a. p. for 8 days from 4th to 11th November 1933. **Entomology Section.** K. R. Ramamurthy, Artist, l. a. p. for 1½ months from 16—10—33 and A. Govinda Menon is appointed in his place to act. **Millet Section.** P. Krishna Rao, Assistant, l. a. p. for 4 months, half average pay for 8 months and 13 days, and study leave for one year. **Cotton Section.** T. V. Rangaswami Iyer, Assistant, A. R. S, Koilpatti l. a. p. for 20 days from 16—10—33 S. P. Fernando A. F. M. Koilpatti, l. a. p. for 3 months on M. C. from 8—11—33. **Paddy Section.** S. Dharmalingam Mudaliar, Assistant, l. a p. for three weeks from 23—10—33. **D. A's Office orders.** N. G. Narayanan, B. Sc. Ag. to officiate as Assistant in the cotton section in the scale of 75—7½/2—105 vice K. L. Ramakrishna Rao, on other duty. C. K. Ramachandran B. Sc. to officiate as Assistant in the cotton section in the scale of 75—7½/2—105 vice S N. Venkataramanan on leave. N. L. Balasundaram to officiate as Assistant, in the paddy section at A. R. S. Maruteru in the scale of 74—7½/2—105 Vice C. V. Saravayya Chetty on leave. A. Chinnathambi Pillai, offg. A. D. A. Guntur, extension of l. a. p. for one month from 16—9—'33. S. Madhava Rao Assistant, in the Millet section will continue to officiate from 29th. October 1933 till further orders. C. Vijayaraghavan, Upper subordinate, l. a. p. for 6 weeks from 28—10—'33. L. Krishnan whose offg. appointment terminates on 6th. November 1933 will continue to officiate from 7th. November 1933 till further orders in one of the temporary posts. **Gazette Notifications.** Dr. J. S. Patel M. Sc., Ph. D., Oil Seeds Specialist, Coimbatore has been appointed temporary coconnut enquiry officer, I. C. A. R. into effect from the forenoon of the 22nd August.

ADDITIONS TO THE LIBRARY DURING AUGUST 1933.

A. Books.

1. The Cultivated Plants of Mexico, Guatemala and Colombia. (Russian with English Summary). *S. M. Bukasov* (1930). 2. Adult Education in Agriculture. (Through Evening Schools). *B. H. Fleener* (1932). 3. Tapioca in Malaya. *V. R. Greenstreet* (1933). 4. Flora of the South Indian Hill Stations—Vol. 1 & II. *P. F. Fyson* (1932). 5. Life and Experiences of a Bengali Chemist—Autobiography. *P. C. Ray* (1932). 6. Indigenous Drugs of India: Their Medical and Economic Aspects. *R. N. Chopra* (1933). 7. The Fauna of British India—Odanata—Vol 1 *F. C. Fraser* (1933). 8. The Science of Prices—3rd Edn. *J. A. Todd* (1931). 9.

Indian Economics—2 Vols. *G. B. Jather & S. G. Beri* (1932). 10. History of Services of the Gazetted officers of the Madras Presidency—corrected up to 1st July 1933. (1933). 11. Asylum Press Almanac and Directory for 1933. (1933). 12. The Fundamental Rules and the Subsidiary Rules of the Madras Government —5th Issue—corrected up to 31st May 1933 (Item Nos. 10, 11 & 12 are not available on loan).

B. Reports.

1. Review of Agricultural Operations in India—1929-30 & 1930-31. 2. Report of the Director, Imperial Institute of Agricultural Research, Pusa for 1931-32. 3. Annual Report of the National Institute for Research in Dairying 1932. 4. Annual Report of the Department of Agriculture, Sierra Leone for the year 1932. 5. Annual Report of the Department of Agriculture, Cyprus, for the year 1932. 6. Annual Report on the Agriculture Department, State of North Borneo for 1932 7. Annual Report for the Fiscal year ending June 30, 1932 of the Florida Agricultural Experiment Station. 8 Forty-Fourth Annual Report of the Vermont Agricultural Experiment Station for 1930-1931 9. Forty-Fifth Annual Report of the Vermont Agricultural Experiment Station for 1931-32.

C. Bulletins, Memoirs &c.

10. The Preservative Treatment of Estate and Farm Timber. *British Wood Preserving Association Circular 1.* 11. The Farm Debt Problem. *U. S. Agri. Dept. Bur. Agri. Econ. Spl. Publ. 1933.* 12. How to Measure and Use Water for Irrigation. *Pullman Eng. Expt. Stn. Eng. Bull. No. 20.* 13. The Story of Wheat. *Purdue Univ Agri. Extn. Pub. 1930.* 14. Economic Aspects of the Marketing of Honey. *U. S Agri. Dept. Bur. Agri. Econ. Pub. Sept. 1932.* 15. Rice Cultivation: Report on a Visit to Ceylon and South India, with Proposals for Sierra Leone. *Sierra Leone Agri. Dept. Spec. Pub 1933.* 16. Report on the Infestation of Cured Tobacco in London by the Cacao Moth Ephestia Elutella HB. 17. Palestine Orange Shipments. 18 Canned and Dried Fruit Supplies in 1932. 19 The Demand for South African Deciduous Fruits. *Emp. Mark. Boa Nos. 67, 68, 69, 70.* 20. The Cultivation of Vegetables in Frames. 21. Insect Pests of Crops—1928-31 22. Turkeys. *Eng. Mini. Agri. & Fish. Bull. Nos. 65, 66, 67.* 23. Soil Erosion *Imp. Bur. Soil Sci. Tech. Comm. 28.* 24. A Brief Summary of the papers published by the staffs of the School of Agriculture and its Associated Research Institutes during the period May 1st, 1932—April 30th, 1933. *Cambridge Univ. School of Agri. Mem. No. 5.* 25 Guide to Experiments and Demonstrations at Askham Bryan Farm, York and in the Country of Yorkshire—1932. 26. Guide to Experiments and Demonstrations at Askham Bryan Farm, York—1933. *Univ of Leeds and the Yorkshire Coun. for Agri. Education Pub. 172, 174.* 27. Nationality of Ownership and Nature of Constitution of Rubber Estates in Malaya. *S. S. & F. M. S. Agri. Dept. Econ Ser. Pub. No. 2.* 28. Weeds and their Control. *Columbia (British) Agri. Dept. Bull. No. 106.* 29. Mineral Deficiency in the Southern Costal Belt of New South Wales. *New South Wales Agri. Dept. Sci. Bull. No. 42.* 30. The Perennial Cultivation of Cotton with Special Reference to the Cultivation of Ratoons in Egypt. 31. Sand-Sowing in Cotton-Breeding 32. Bee-Keeping in Palestine and Egypt Compared—June 1927. 33. The Branching of Egyptian Cotton Plants. 34. The Natural Crossing of Cotton Flowers in Egypt. *Egypt. Mini. Agri. Tech. & Sci. Ser. Bull. Nos. 75, 80, 82, 87, 89.* 35. Agricultural Investigations at the Huntley (Mont.) Field Station, 1927-1930. 36. Curly-Top Resistance in Sugar Beets and Tests of the Resistant Variety U. S. No. 1. 37. The Hessian Fly in the Pacific Northwest. 38. The Parasites of the Sugarcane Borer in Argentina and Peru, and Their introduction into the United States. 39. The Composition and Distribution of Phosphate Rock with Special Reference to the United States *U. S. Agri. Dept. Tech. Bull. Nos. 353, 360, 361, 363, 364.* 40. Preparing Peaches for

Market. *U. S. A. Farm. Bull. 1702.* 41. Multiple Correlation Analysis as applied to Farm-Management Research. 42. Studies on the Downy Mildew of Onions, and the Casual Organism, Peronospora Destructor (Berk) Caspary. 43. The Physical Volume of Production in the United States. 44. Relation of Hydrogen-ion Concentration to the Growth of Onions. 45. The Buffer Capacity of Peat Soils. *Cornell A. E. S. Mem. 141, 143, 144, 145, 146.* 46. Retail Prices of Fertilizer Materials and Mixed Fertilizers. 47. Corn and Soybeans for Silage. 48. Economic Studies of Dairy Farming in New York. 49. The Effect of Certain Mineral Elements on the Color and Thickness of Onion Scales. 50. Studies of Potato Storage. *Cornell A. E. S Bull. Nos. 545, 548, 551, 552, 553.* 51. Farm Production Costs in Oklahoma, 1931 *Bull. No. 208 of Oklahoma A. E. S.* 52. Bacteriology of Butter: V Studies on the Microorganisms in Churns. *Iowa A. E. S. Res. Bull. No. 159.* 53. Linebreeding. *Iowa A. E. S. Bull. No. 301.* 54. Carotin-The Principal Natural Yellow Pigment of Milk Fat-Part II Chemical and Physiological Relations of Pigments of Milk Fat to the Carotin and Xanthophylls of Green Plants. 55. The Mode of Inheritance of Yearly Butter Fat Production :- An Analysis of the Progeny performance of Holstein—Friesian Sires. 56. The Development of the Mammary Gland as indicated by the Initiation and Increase in the Yield of Secretion *Missouri A. E. S. Res. Bull. Nos. 10, 144, 156.* 57. Pregnancy Disease of Sheep 58. Carloan Shipments of Livestock from North Dakota Farms. 59. Barley Production in North Dakota. 60. Leafy Spurge Life History and Habits. 61 Gooseberries. *N. Dakota A. E. S. Tech. Bull. Nos. 261, 262, 264, 266, 267.* 62. Grading, Packing and Stowing Florida Produce. 63. Soybeans for Silage. 64 Some Diseases of Cabbage and other Crucifers in Florida. 65. The Pollination of Avacados. *Florida A. E. S. Bull. Nos. 254, 255, 256, 257.* 66. Anthracnose and Gray Bark of Red Raspberries 67. A Study of the Structure of the Skin and Pubescense of the Peach in Relation to Brushing. 68. Supply and Marketing of Soybeans Products. *Illinois A. E. S. Bull Nos. 383, 385, 386.* 69. Home Storage of Fruits and Vegetables. *Ohio A. E. S. Bull. No. 123.* 70. The United States Export and Import Trade in Dairy Products. *Michigan A. E. S. Tech. Bull. No. 131.* 71. Success and Failure in Spraying for Scab and Codling Moth. *Michigan A. E. S. Spl. Bull. No. 230.* 72. Studies in North American Violets: II-The Cytology of Some Sterile F_1 Violet Hybrids. 73. The Production of High Quality Milk-III-Electric Cooling Versus Ice Cooling. 74. Studies in Vermont Dairy Farming: VII.-Charlotte Ferrisburg and Panton Area. 75. Calcium and Phosphorus Requirements of Dairy Cows—I.-Weekly Balances through Lactation and Gestation Periods. 76. The Supplemental Value of Fish Meal As a Feed for Dairy Cattle. 77. A Study of the Fat-Globule Size in Milk 78. Calcium and Phosphorus Requirements of Dairy Cows :- II.—Weekly Balances through Lactation and Gestation Periods. 79. The Production of High Quality Milk IV,—The Influence of delayed Cooling combined with other Cooling practices upon the quality of Milk. 80 An Economic Study of the Organization, Finance and Operations of Farmers' Business Co-operatives in Vermont. 81. The Digestibility of Artificially Dried Grass. 82. The Feeding Value of Artificially Dried Young Grass. *Vermont A. E. S. Bull. Nos. 325, 326, 329, 331, 333, 341, 342, 343, 346, 348, 350.* 83. Some Studies of Root Habits of Sugarcane in Cuba *Trop Plant Res Found Sci, Cent. No. 21.* 84. Progress of Investigations, Abstracts of Papers not included in Bulletins, Finances, Meteorology, Index. *Maine A.E.S, Bull. No. 360.*

D. Circulars, Leaflets &c.

85. An Act to Provide for the better regulation of buying and selling of commercial crops and the establishments of markets for commercial, crops, in the Presidency of Madras *Madras Act of 1933.* 86. Improvement of Broach Cotton. *I. C. C. C. Press Bulletins.* 87. The Effect of Climate on the Composition of Pasture Plants. *Imp. Bar. Animal Nutrition, Occ. Comm. Australia.* 88. Fibres :—A Summary of Figures of Production and Trade Relating to Cotton Wool, Silk,

Hemp, Flax, Jute. *E M. E. C-6.* 89. Budding and Grafting Trials with Cotton and Related Plants. 90. A Pest of Cured Tobacco, Ephestia Elutella Hubner. 91. Contact Sprays for the Japanese Beetle. *U. S. Agri. Dept. Cir. Nos. 267, 269, 280.* 92. How to Control Ragweed the Principal Cause of Autumn Hay Fever. *U. S. Agri. Dept Leaf. 95.* 93. The Header Barge Method of Harvesting. *Alberta Uni. Cir. 14.* 94. Planning and Planting the Home Grounds. 95. Home Gardens. *Wiscon Univ. Cir. Nos. 253, 254.* 96. Farm Poultry Equipment. 97. Weed Seed Facts. 98. Care of Brood Mare and Colt. *N. Dakota Cir. Nos. 115, 116, 117.* 99. Easter Lily Mosaic. 100. Mosaic Diseases of Vegetable Plants. 101. Rose Canker. 102. Black Spot of Roses. 103. Powdery Mildew of Roses. 104. Yellowing of Centipede Grass and its control. 105. Preparation of Lime-Sulphur Spray. 106. Methods for preparing Bordeax Mixture. 107. Clitocype Mushroom Root Rot of Woody Plants. 108 Selection and Shipment of Plant Specimens for Diagnosis or Identification. 109 Rhizoctoniose, A Common Disease of Plants. *Florida A. E. S. Press. Bull. Nos. 445, 446, 447, 448, 449, 450, 452, 453, 454, 455, 456.* 110. Bacillary White Diarrhoea of Chicks. 111. The Cultivation of Raspberrise. 112. Spurrey. 113 Narissus Flies. 114. Faults and Difficulties in Buttermaking. *Eng. Mini. Agri. & Fish. Adv. Leaf. 168, 180, 182, 183. 184.* 115. Importation of Plants, Fruit etc., into Cyprus. *Cyprus Agri. Dept. Leaf. 20.*

E. Reprints.

116. Chlorophyll Deficiencies induced in Cotton (Gossypium hirsutum) by Radiations. 117. Radiation-Induced Variation in Cotton. 118. World Sugar Situation. 119. Wheat in Brazil.

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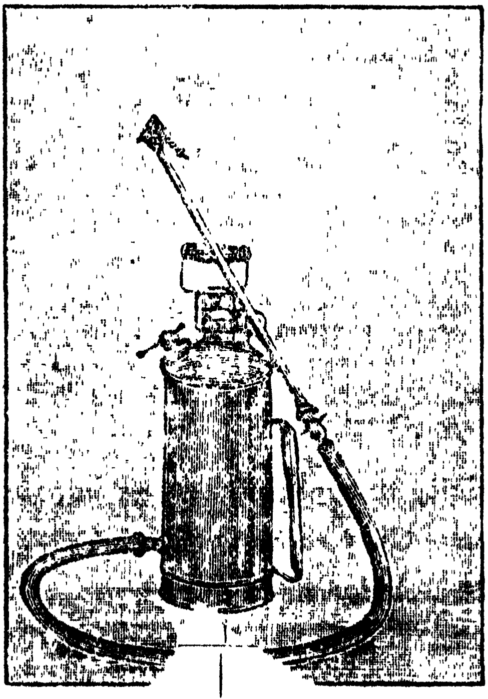

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STUDIES IN CAPSICUM.*

I. ANTHESIS, POLLINATION AND FERTILISATION

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Introduction. Chillies, though broadly classified under condiments and spices stand next in importance to the staple food crops in India. The crop in spite of its being an introduced one from South America (Watt. 8.) has established very well in the country and created a special taste for the people at large. The necessity for chillies is all the more felt in the Madras Presidency as it forms one of the daily requirements of both the rich and the poor alike. The value of the crop is enhanced further by the discovery of Quinn, Burtis and Milner (5) of the presence of vitamins A, B and C in the green chillies. Considering the deterioration of the crop to an alarming extent in the Guntur district both in the quantity and quality, work on the improvement of this essential crop was taken up at the Agricultural Research Station, Guntur. A definite knowledge as to the anthesis, methods of pollination and the occurrence of cross-fertilisation is necessary for the improvement of any crop. The process of anthesis is a delicate one and it invariably varies with the weather conditions such that the observations recorded at one place might not hold good at another. An accurate information on the above phases facilitates the choice of the methods of improvement to be adopted, the testing of the new varieties as well as the combating of the insect pests and plant diseases by evolving disease-resistant types.

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* Paper which won the Ramasastrulu-Munagala Medal, 1933.

Material. The investigations were started in the year 1931-32 and were continued in the next season so as to confirm the findings of the previous year. The first year's observations were restricted to *Nallapadu* type of chillies, (*Capsicum annuum*) and the same were extended to some more species during the year 1932-33 as given below. In all, four species and six types of chillies were examined of which the first three types are cultivated in the Guntur District.

Particulars.	Pedicel.	Colour of fruit		Type of fruit	Habit of the matured fruit
		Green	Ripe		
1. *C. annuum* :-					
(a) Bellary chillies	Solitary	Green	Red	Broad & long	Pendent
(b) Nallapadu „	Do.	Dark Green	Red	Narrow & long	Do.
(c) Local „	Do.	Do.	Red	Stout & short	Do.
2. *C. annuum-var-accuminata pendula* :-					
(d) Yellow chillies	Do.	Light green	Yellow	Medium broad and long to short	Do.
3. *C. annum-var-nigra* :-					
(e) Black chillies	Do.	Black	Red	Thin & short	Erect
4. *C. frutescens* :-					
(f) Needle chillies	Twos & Threes	Green	Red	Very thin & small.	Do.

Method. In the first year of observations the period of anthesis was determined by labelling a certain number of well developed flower buds that are to open on the next day and the progress of flowering was noted at intervals of one hour from 2-0 a. m. till all the buds opened. The study was made at the end of every month from November to February but in the succeeding year it was felt that if the observations were to be limited to individual plants the results obtained will give a better insight into the subject. With this end in view, five plants from each of the above mentioned six types were selected for the purpose. The observations on anthesis were attended to throughout the night and day at intervals of one hour while the details of anthesis were made once in a week. The identity of the observed flowers was maintained by tagging the flowers with their respective serial numbers and the date of opening.

Biology of the Flower. Before getting into the details of the subject, the general description of the *Capsicum annuum* flower is given below. The description given by Duthie, (1) and Erwin (2) are consulted though the one given by Shaw (6) is very closely followed.

Flower.	The flower is one pedicelled; axillary ; solitary and regular.
Calyx.	Companulate: minutely 5 or 6 lobed, much shorter than the fruit and completely covers the base of the bud
Corolla	Rotate, Five lobed and valvate in bud. Lobed three veined, and curved at the tips.
Stamens.	Five or six as the case may be, adnate and are attached near the base of the corolla.
Anthers.	Not connivent in cone, not longer than the filaments, dehiscing longitudinally by lateral slits.
Style.	Linear.
Stigma.	Sub capitate and bi-fid.
Ovary.	Two celled with the connate carpels.

Observations made at Guntur indicate that flowers with five lobes are common with a variation of ± 1 in 2 per cent of the flowers produced per plant. In addition to the above, cases of flowers having unequal number of stamens to the number of corolla lobes were also noticed. The difference found was one, being always on the reduction side.

Floral Secretion. During the course of anthesis studies in 1931, the writer observed several insects hovering in the chilli plot as early as 4 a. m. The attraction of insects to the chilli flowers in spite of their being non-odorous, un-attractive, pendent, and partly hidden by foliage created a curiosity for examining the flowers for floral secretions if any. On careful examination small globules of sweet liquid were noticed on the inner side of the petals as well as at the places where the filaments are attached to the corolla. Usually the secretion commences by about 4 a. m. No mention of such secretion in chilli flowers is made by the other workers in India but Erwin (2) states that the phenomenon was noted by him at Iowa about the same time. On analysis he found the Osazone of dextrose in the nectar secreted by the chilli flowers.

Details of Floral Parts :—

(a) *Pedicel.* Usually in the common forms of chilli plant the pedicel is solitary and axillary but in some species they arise in numbers. The matured pedicel is either erect or pendent. The length and size of the pedicel varies with the type of chilli plant. In almost all the cases it is green but in a few cases it is either streaked with purple or remains completely violet.

(b) *Calyx.* In the tender stages of the bud, the calyx completely encloses the flower bud in most of the cases. As the bud developes the calyx widens leaving space for the developing bud to come up. Like the pedicel the calyx is green in colour but in a few cases it is either streaked with purple or remains completely purple. In the majority of cases it is persistent and remains attached with the fruit while in a few cases it is loose and comes off easily either at the time of collection or storing.

(c) *Corolla.* The colour of the petals is white in general but in some types it is either dirty white to yellowish green or violet with varying intensities as in the case of black chillies.

(d) *Filaments.* These are either white or pigmented and are as long as the anthers or even slightly longer.

(e) *Anthers.* The general hue is green but cases of light green and violet coloured anthers are also present in some types of chillies.

(f) *Style.* The style is of different lengths in flowers produced by a single plant on the same day. It is either light yellowish green or purple. Cases of bent styles are also reported by Shaw (6).

(g) *Stigma.* This may be coloured purple or remains light green according to the types of the chilli plant. The number of stigmatic lobes in their turn vary with the species and as many as two to three lobes were observed by the writer in the six types of chillies under consideration.

Appearance of the first Flower. The appearance of the first flower in the chilli crop commences from the sixth week after sowing and is usually found in the nurseries. The production of the first flower varies with the type and vigour of the plant. For a chilli cultivator the appearance of the first flower is a signal to get his nurseries topped.

Development of the Flower-bud. To start with, the bud is minute and appears as a green speck between to linear lanceolate leaves. The bud takes two to three days for the formation of the pedicel. The calyx remains closed till the bud attains the fifth day when a bend forms in the pedicel either at the base or just below the calyx. In another two or three days the corolla pushes out and takes seven to eight days for opening. The relative positions of the stigma and anthers vary in the bud. In the young bud the anthers and the stigma are at the same level but the style grows more rapidly than the stamens and hence in an open flower the style is found to be 1 to 2 mm. longer than the stamens. By the time the flower opens the development of the anthers and stigma will be completed as no further growth in size was noticed under the Guntur conditions. On the same plant we come across flowers having styles longer than the staminal column, styles flush with the staminal column and styles shorter than the staminal column. Counts taken from the flowers produced by the same plant throughout the flowering season gave the following results :—

Type of Chilli plant,	Nature of style.			
	Longer.	Flush.	Shorter.	Total.
Bellary	67	56	19	142
Nallapadu	104	39	7	150
Local	81	59	11	151
Yellow	187	20	10	217
Black	51	12	4	67
Needle	151	8	5	164

Of the six types of chillies only the flowers of Needle chillies have a greater percentage of longer styles.

Order of Flowering. Flowers in the chilli crop arise from the axils and no definite order of opening can be specified as the branching is dichotomous. The earliest flowers appear among the older (i. e.) on the lower branches and the younger flowers occur on the branches nearer the apex of the stem. In a branch the flowering follows the same order, the older ones being nearer the main stem.

Duration of Flowering. The transplanting of the seedlings is usually done in September and the flowering commences from October and extends up to February. Stray flowers do appear till the end of February. In general, the flowering extends over a period of three months with the maximum flush occurring between the end of November and the beginning of December (Fig. 1). The maximum variation in the flowering period of the six types under consideration was eight days and the mean was eighty-six days. Of the six types, Bellary and Black chillies had the minimum period of eighty-one days and the Local had the maximum of eighty-nine days.

Progress of Flowering in a day. Shaw & Khan (6) mention that under Bihar conditions chilli flowers open at about 7-30 a. m. and continue opening till 1 p. m. with the majority of the buds opening between 8 and 10 a. m. They further state that in a few cases the opening extends up to 3 p. m. while some buds remain in an unopened or partially opened condition which in their turn open fully earlier than the buds that are to open the next day.

Shrivatsava (7) working on chillies in Bihar and Central Provinces found that in the month of October on a clear day all the flower buds observed by him opened between 4 and 7 a. m. He added further that on a cloudy morning the flower buds prolong their opening and continue opening till 9 a. m. In a few cases he noticed them to open as early as 1 a. m. and as late as 12 noon.

Erwin (2) working at Iowa states that the period of anthesis in chillies is comparatively short and in most cases less than a full day. His observations were made on 18—8—31 by noting the flower opening at half hour intervals starting just after sun rise (i. e.) 5—15 a. m. and continued till 10 a. m.

Chilli flowers as observed at Guntur commenced opening as early as 2 a. m. and continue up to 4 a. m. as indicated below. Of the total number of flowers that open on any one day, the major part of them blossom by 6 a. m. and only in a very few cases the opening is delayed. Dewy nights and cloudy atmospheric conditions retard the normal progress of anthesis and cause the buds to open late. Cases of buds opening late in the evening and the unopened buds of a particular day opening earlier to the flower buds that are to open on the next day were also noticed. The opening of such buds usually takes place between 0 and 1 a. m. as given below. The following table gives the total number of flower buds observed under each type of plant and the distribution of the anthesis activity. Though the observations were made in 5 plants under each of the types the results of a single typical plant are given for having a clear and definite idea of the time.

Type of Chilli plant.	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-4	Total
	A. M.												P.M.	
						1931—32.								
Nallapadu	9	28	39	58	43	31	10	8	3	2	...	...	9	240
						1932—33.								
Bellary	6	36	36	34	23	13	14	3	8	2	2	...	5	182
Nallapadu	7	30	32	41	21	22	3	2	...	...	...	...	2	160
Local	9	56	41	32	22	12	2	10	6	4	...	...	6	200
Yellow	10	17	37	65	59	39	7	14	4	...	...	...	11	263
Black	2	7	13	23	24	12	2	14	3	6	4	1	2	113
Needle	15	23	24	40	60	51	12	16	5	8	3	3	20	280

N. B:— The number of buds given under 0–1 a. m. are the immature buds opened on the next day.

Of the six types of chillies examined, the flowers of Black and Needle chillies open comparatively late, but in general the maximum activity of anthesis occurs between 2 and 6 a. m. Table II in the annexed appendix gives the fuller details of the anthesis energy at fortnight intervals. A cursory glance at Tables I and II in the appendix indicate that the vigour of the anthesis is directly controlled by the atmospheric conditions.

Dehiscence of anthers at Guntur was found to follow rather than be simultaneous with the opening of the flowers. The following table gives the rate of anther dehiscence under each type of chilli flowers.

Type of chilli plant.	6—7 A.M.	7—8 A.M.	8—9 A.M.	9—10 A.M.	10—11 A.M.	11—12 Noon.	Immature.	Total.
			1931—32					
Nallapadu	56	87	63	19	6	...	9	240
			1932—33					
Bellary	47	50	37	11	19	6	12	182
Nallapadu	32	35	46	31	4	2	10	160
Local	36	53	56	26	12	3	14	200
Yellow	34	89	64	30	22	2	22	263
Black	...	27	30	26	12	11	6	113
Needle	1	24	65	44	61	53	32	280

Similar to the flower opening the anther dehiscence in Black and Needle chillies commence late. In general, the dehiscence starts only after sun rise and this indicates that the atmospheric temperature is the determining factor for the activity of anther dehiscence. For fuller details (vide) Table III.

General Anthesis. Fully matured chilli bud appears like a knob and just when the bud commences to open, an aperture is formed at the top of the bud (i. e) the junction at which all the corolla lobes meet. The aperture gradually increases in size and extends top downwards along the margins of the lobes. The slit extends right down to the bottom whereby the corolla lobes get separated, one from the other. After some time, the lobes spread themselves flat and recurve upwards by about 8 a. m. It is by this time that the majority of anthers dehisce. The bursting of anthers invariably begins from top and runs downwards along the edge of the anthers. After the dehiscence, the edges of the pollen sacs gradually get folded outwards exposing the pollen grain fully. Even the slightest touch causes the pollen to fall freely and on a windy day in about half an hour after the opening, all the sacs become empty. To a certain extent bees are also responsible for removing the pollen from the burst anthers.

The flowers commence closing from about 5 p. m. on the day of opening and remain closed during the night. Once again they commence opening from 4 a. m. on the next day and close finally by the evening. The corolla along with the stamens sheds in the course of another twelve hours. The stigma remains attached to the fertilised ovary for some days or even dries up and sheds in a day or two according to the prevailing weather conditions.

Shaw (6) mentions that in Pusa, chilli flowers remain open for two or three days without closing. In Bihar and Central Provinces the chilli flowers were observed by Shrivatsava (7) to remain fully open and turgid till 4 p. m. and get closed on the day of opening. The closed flowers were said to open once again between 4 and 7 a. m. on the next day and remain fresh and turgid as before and finally get closed at 6 p. m.

Details of Anthesis:—Two plants from each of the six types of chillies were selected and the detailed observations of anthesis were attended to on week ending Saturdays. The observations were carried throughout the flowering season and the details of a typical single flower of Bellary chillies are given below:—

Particulars.	Actual timing.	Interval from the opening of flower.	Date.
		Hours.	
1. Commencement of corolla opening	2-00 a. m.	—	5—11—32
2. Separation of corolla lobes	5-00 „	3-00	„
3. Secretion of nectar	5-00 „	3-00	„
4. Recurving of corolla lobes	8-00 „	6-00	„
5. Commencement of anther dehiscence	7-15 „	5-15	„
6. Do in all the anthers	8-50 „	6-50	„
7. Completion of dehiscence	10-00 „	8-00	„
8 Folding of corolla lobes	4-45 p. m.	14-45	„
9. Opening of corolla	5-00 p m.	27-00	6—11—32
10. Final folding of corolla	4-00 p. m.	38-00	„
11. Shedding of corolla	Night.		„
12. Drying of style and stigma	3-00 a. m.	61-00	7—11—32
13. Shedding of style and stigma	10-00 a. m.	80-00	8—11—32

The details of the other types are given in Table IV in the annexed appendix.

With a view to see whether the time of the opening has got anything to do with the other phases of anthesis, flowers opened on the same plant at different hours on the same day were examined and the results are given in Table No. V of the appendix. The effect as can be seen from the table is significant (i. e.) the time interval is inversely proportional to the time of opening of the flower buds. Observations made at different ages of plants also showed marked difference in the time interval of the different phases of anthesis having the time of opening of the flower as the basis. As in the above cases, the time intervals diminish with the age of the plant.

Pollination. The study of pollination enunciated the factors contributing to fertilisation. Observations made at Guntur indicate that the pollination in chilli crop is effected by several natural agencies such as wind, Thrips (*Scirtothrips dorsalis* Hood), Bugs (*Nezara viridula*), Bees (*Apis florea*), Butterflies (*Papilio demoleus, Terias hecabe, Papilio aristolochae*) and small black ants (*Camponotus compressus*). Every one of them in its turn contributes its quota for the general role of pollination and fertilisation. The activity of the agencies commences as early as 4 a. m. and continues till about 12 noon or even later. The position of the stigma in chilli flowers suggests that the flowers are self pollinated as the flowers are either pendent or half-pendent due to the bending of the pedicel. The style is usually straight and longer than the stamens and hence the chances for the stigma are many for receiving the pollen of the anthers of the same flower.

Shaw (6) points out that in many varieties of chillies a certain percentage of the flowers possess curved styles instead of straight ones and that these shorten the distance between stigma and anthers whereby the stigma will be placed in a more favourable position for receiving the pollen of its own flower. The writer did not come across such bent styles in the several varieties grown at Guntur during the two seasons. Shrivatsav (7) pronounces that the chilli flowers are ordinarily self-pollinated.

Cross Fertilisation. Cross fertilisation in chillies is not uncommon for the fact that anther dehiscence starts much later than the opening of the flowers. Besides this, in some flowers the anthers do not burst due to some unfavourable physiological conditions. In such instances the only resort for the stigma is to depend on the pollen of other flowers.

Hector (4) found the chilli flowers to favour a certain amount of cross fertilisation. Erwin (2) mentions that chilli plant being a nectar bearing one attracts insects and as a result of that cross pollination is likely to occur. Shrivatsava (7) mentions that the anther sacs burst simultaneously with the opening of the flower but the observations recorded by Shaw (6) and the writer in 1931 & 32 indicate that the anther dehiscence takes place at least an hour after the opening of the flower which in its turn depends on the diurnal atmospheric conditions. The interval varies from 1 to 10 hours as given below. In very few cases the anthers were found to remain in an unburst state. The delay in the bursting of anthers as expressed by Shaw (6) favours cross fertilistion.

Type of chilli plant.	Interval of anther dehiscence from the time of flower opening.										Total.
	1	2	3	4	5	6	7	8	9	10	
Bellary	16	16	30	32	45	15	11	1	...	2	168
Nallapadu	7	4	13	46	46	18	9	6	2	...	151
Local	5	13	17	36	52	36	20	4	1	1	184
Yellow	8	23	43	56	49	16	5	1	...	...	201
Black	2	5	16	25	28	14	7	1	...	...	98
Needle	7	4	13	46	46	18	9	6	2	...	151

The above figures indicate that the maximum bursting of anthers takes place between 3 to 5 hours since the opening of the flower.

Percentage of Natural Crossing. For determining this, a ready method was devised whereby the flower buds that are to open on the next day were bagged with tissue paper covers at about 6 p. m. The protected buds were emasculated early next morning at 5-30 a. m before the anthers could possibly dehisce. These were allowed to be cross pollinated and the setting of the same was examined on the seventh day. The observations were carried out at the end of every month in the two seasons. The details of the results are given in Table No. VI. On an average it was found to be seven per cent under the Guntur conditions. Shrivatsava (7) noted the percentage of of natural crossing in chillies as two to five per cent. Shaw (6) found that out of the ninety seven naturally fertilised cultures seventy five were found to be splitting for the parental characters. Erwin (2) mentions that he found eighty per cent of open pollination. Out of the thirty cultures raised by the writer in 1932 from the produce of single plants, two were found to be impure for parental characters. Though the figure obtained is low yet it is in conformity with the one mentioned by Shrivatsava (7)

Receptivity of Stigma and longevity of Pollen. A knowledge on this subject of the concerned crop is of vital importance for a plant breeder. Detailed observations were carried out for the last two seasons and as the subject forms a separate paper the matter is not dilated on at the present stage. The experiences gained so far indicate that the stigma in a chilli crop remains receptive for about twenty-four hours from the time of opening and the viability of the pollen lasts for twenty-four hours under the field conditions at Guntur.

Fertilisation. It is evident from the above fact that in chillies both cross and self fertilisation take place. Usually the setting of the early formed flowers is very low due to the dewy nights and heavy rainfall in the Guntur District (Gopalaratnam 3). Flowering period in chillies extends well nigh over a period of three months. *Mutatis mutandis* the fruitang period also extends from December to March.

Percentage of Shedding and Setting. As the space is limited only a meagre sketch of the work done in this direction is given below. *Capsicum annuum* alone was selected for the purpose and the investigations were made in the first two types of chillies. Five representative plants of the two types were selected in the field and the daily census of flower production was recorded throughout the flowering season but given as weekly totals per plant in Table VII. The flowers were tagged with the dated labels, and counts of the developed chillies were taken from time to time. The percentage of setting in the two types was found to be as low as 6 per cent on the average.

Maturation Period of the Fruit. This, like any other economic character varies with the variety and the age of the plant. Shaw (6) recorded that the ripening of the chilli fruit takes 2 to 2½ months. At Guntur the observations made in all the six types gave the following results.

Type of chilli plant.	Number of days taken for the chilli fruit to mature.		
	Mean.	Minimum.	Maximum.
Bellary	59	49	77
Nallapadu	57	49	62
Local	56	50	62
Yellow	60	52	70
Black	57	51	70
Needle	51	47	55

The above table indicates that the Needle chillies have the minimum maturation period of forty-seven days and the Bellary chillies have the maximum maturation period of seventy-seven days while the mean maturation period among the six types ranges from fifty one to sixty days as given in Table VIII. It was also found that the maturation pariod is directly correlated with the age of the plant, the coefficient of correlation (*r*) being 0·41 and P. E. 0·05 for all the six types of chillies examined.

Summary. 1. Chilli flowers commence opening as early as 2 a.m. and continue till 4 p.m. with the maximum rush of anthesis occurring between 3 and 6 a.m.

2. Anther dehiscence commences at least an hour after the opening of any flower but the mode of dehiscence can be noticed between three and five hours after the flowers open.

3. The activity of anthesis and anther dehiscence are directly influenced by the diurnal atmospheric conditions.

4. The time intervals of the different phases of anthesis diminish with the advancement of the age of the plant and the time of flowering.

5. Chilli flowers commence to secrete nectar by about 4 a.m.

6. Chilli flowers are both self and cross pollinated with the percentage of natural crossing working to seven under the Guntur conditions.

7. The receptivity of the stigma and the viability of the pollen in chilli plants lasts for twenty-four hours under the field conditions of Agricultural Research Station, Guntur.

8. The percentage of setting to the number of flowers produced per plant is found to be six on an average.

9. Maturation period of the chilli fruit varies from forty-seven to seventy-seven days in all the six types of chillies examined and is directly correlated with the age of the plant.

Acknowledgments. My acknowledgments are due to the Deputy Director of Agriculture, II Circle, Guntur, for the facilities accorded and to the second Cotton Assistant and the fieldmen for their hearty co-operation in the work.

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APPENDIX

Table I.

Details of Atmospheric Temperature and Rainfall.

Particulars.	Temperature in degrees Farenheit.											Av. Mini.	Av. Maxi.	Rainfall.
	2	3	4	5	6	7 A. M.	8	9	10	11	12			
	1931—'32.													
Novr 30th.	76	77	78	79	80	86	87	89	90	92	94	82	93	Nil.
Decr. 31st.	75	76	77	77	78	79	81	83	85	86	88	76	88	Nil.
Jan. 31st.	62	63	65	67	68	70	72	75	76	77	78	72	79	Nil.
	1932—'33.													
Novr. 1st.	81	82	83	84	85	87	89	89	90	90	91	80	91	0·08"
Novr. 15th.	77	78	79	80	80	81	82	83	86	87	87	76	88	0·10"
Decr. 1st.	76	77	78	78	79	79	80	81	84	83	85	77	86	0·19"
Decr. 15th.	73	74	75	76	76	78	79	81	82	83	85	70	85	Nil.
Jan. 1st.	71	70	71	73	69	71	77	79	81	84	88	68	87	Nil.
Jan. 15th.	71	70	69	71	68	69	76	80	82	83	85	68	88	Nil.

Table II.

Details of Anthesis energy at fortnightly intervals.

Period.	0—1 a. m.	1—2 a. m.	2—3 a. m.	3—4 a. m.	4—5 a. m.	5—6 a. m.	6—7 a. m.	7—8 a. m.	8—9 a. m.	9—10 a. m.	10—11 a. m.	11—12 Noon.	12—4 p. m.	Total.	Variety of Chilli.
							1931—'32.								
30th Nov.	5	2	2	16	25	16	7	2	2	2			5	84	Nallapadu.
31st Dec.	4	18	25	31	15	13	2	5	1	-			3	117	
31st Jan.	-	8	12	11	3	2	1	1	-	-			1	39	
Total.	9	28	39	58	43	31	10	8	3	2			9	240	
							1932—'33.								
1st Nov.	1	-	6	2	1	-	2						-	12	Bellary.
15th Nov.	2	5	8	16	9	4	-						1	45	
1st Dec.	1	22	17	10	8	7	-						3	68	
15th Dec.	2	-	3	3	1	-	1	3	3				-	16	
1st Jan.	-	6	2	3	4	2	8	-	5	2	2		1	35	
15th Jan.	-	3	-	-	-	-	3	-	-	-	-		-	6	
Total.	6	36	36	34	23	13	14	3	8	2	2		5	182	
1st Nov.	-	-	-	-	2								-	2	Nallapadu.
15th Nov.	1	6	10	22	9	6	1						-	55	
1st Dec.	3	22	19	19	8	15	2						1	89	
15th Dec.	1	1	3	-	2	-	-	2					1	10	
1st Jan.	2	-	-	-	-	-	-	-					-	2	
15th Jan.	-	1	-	-	-	1	-	-					-	2	
Total.	7	30	32	41	21	22	3	2					2	160	
1st Nov.	1	2	2	4	2	1	-	1					1	14	Local.
15th Nov.	2	10	16	10	5	-	-	-					2	45	
1st Dec.	3	26	15	14	7	7	1	-					1	74	
15th Dec.	2	8	7	2	3	1	-	7	2	1			2	35	
1st Jan.	1	3	-	-	3	2	1	2	4	3			-	19	
15th Jan.	-	7	1	2	2	1	-	-	-	-			-	13	
Total.	9	56	41	32	22	12	2	10	6	4			6	200	

Table II. (*Contd.*)

Details of Anthesis energy at fortnightly intervals.

Period.	0—1 a. m.	1—2 a. m.	2—3 a. m.	3—4 a. m.	4—5 a. m.	5—6 a. m.	6—7 a. m.	7—8 a. m.	8—9 a. m.	9—10 a. m.	10—11 a. m.	11—12 Noon.	12—4 p. m.	Total.	Variety of Chilli.
1st Nov.	2	4	9	8	6	1	-	-	-				2	32	Yellow.
15th Nov.	1	-	5	11	3	8	1	-	-				3	32	
1st Dec.	4	1	13	21	17	5	-	-	-				4	65	
15th Dec.	-	3	3	7	11	14	6	8	3				-	55	
1st Jan.	3	3	3	12	12	6	-	5	1				2	47	
15th Jan.	-	6	4	6	10	5	-	1	-				-	32	
Total.	10	17	37	65	59	39	7	14	4				11	263	
1st Nov.	-	-	-	-	-	-	-	-	-				-	-	Black.
15th Nov.	-	-	-	-	-	-	-	-	-	1	1	-	-	2	
1st Dec.	1	4	12	10	5	5	-	-	-	2	1	-	1	41	
15th Dec.	-	1	-	12	13	2	-	7	3	2	2	1	1	44	
1st Jan.	-	-	-	-	2	-	-	3	-	1	-	-	-	6	
15th Jan.	1	2	1	1	4	5	2	4	-	-	-	-	-	20	
Total.	2	7	13	23	24	12	2	14	3	6	4	1	2	113	
1st Nov.	2	1	5	10	5	6	-	4					5	38	Needle.
15th Nov.	8	2	2	6	21	7	5	1	-	1	-	-	2	55	
1st Dec.	1	1	-	4	8	14	-	-	-	2	1	2	6	39	
15th Dec.	3	-	2	5	9	2	2	8	3	3	1	1	4	43	
1st Jan.	1	8	7	9	13	19	5	3	2	1	1	-	3	72	
15th Jan.	-	11	8	6	4	5	-	-	-	1	-	-	-	35	
Total.	15	23	24	40	60	53	12	16	5	8	3	3	20	282	

Table III.

Details of Anther dehiscence.

Particulars,	6—7 a. m.	7—8 a. m.	8—9 a. m.	9—10 a. m.	10—11 a. m.	11—12 Noon	Immature.	Total	Type of Chilli.
			1931-32						
30th Nov.	22	33	22	2	2	...	3	84	Nallapadu
31st Dec.	24	35	34	16	3	...	5	117	
31st Jan.	10	9	7	1	1	...	1	39	
Total.	56	87	63	19	6	...	9	240	
			1932—33						
1st Nov.	...	10	1	...	...	...	2	13	Bellary.
15th Nov.	20	7	12	2	...	...	1	42	
1st Dec.	26	24	12	...	2	...	6	70	
15th Dec.	...	...	6	5	3	...	3	17	
1st Jan.	1	8	2	3	14	6	...	34	
15th Jan.	...	1	4	1	...	...	...	6	
Total.	47	50	37	11	19	6	12	182	
1st Nov.	...	1	...	1	...	...	...	2	Nallapadu.
15th Nov.	6	13	19	16	...	...	3	57	
1st Dec.	26	20	24	9	3	2	4	88	
15th Dec.	...	1	3	2	1	...	2	9	
1st Jan.	...	...	...	...	...	...	...	...	
15th Jan.	...	...	...	3	...	...	1	4	
Total.	32	35	46	31	4	2	10	160	
1st Nov	...	8	3	1	...	...	...	12	Local.
15th Nov.	17	9	11	4	...	...	2	43	
1st Dec.	18	27	14	7	6	...	7	79	
15th Dec.	1	5	16	8	1	—	1	32	
1st Jan.	...	...	5	6	5	2	4	22	
15th Jan.	...	4	7	...	...	1	...	12	
Total.	36	53	56	26	12	3	14	200	
1st Nov.	6	20	2	...	...	...	...	28	Yellow.
15th Nov,	7	14	15	1	1	...	9	47	
1st Dec.	12	26	19	7	10	...	5	79	
15th Dec.	...	13	10	9	11	...	6	49	
1st Jan.	6	8	8	8	...	1	1	32	
15th Jan,	3	8	10	5	...	1	1	28	
Total.	34	89	64	30	22	2	22	263	
1st Nov.	...	...	...	...	...	...	...	...	Black.
15th Nov.	...	...	...	...	...	...	...	...	
1st Dec,	...	28	17	17	...	6	3	71	
15th Dec.	...	...	5	...	7	1	1	14	
1st Jan.	...	...	1	...	2	2	1	6	
15th Jan.	...	...	7	9	3	2	1	22	
Total.	...	28	30	26	12	11	6	113	
1st Nov.	...	4	8	1	11	4	1	32	Needle.
15th Nov,	1	15	29	16	14	9	15	99	
1st Dec.	...	1	25	18	7	6	10	67	
15th Dec.	...	...	...	2	4	8	3	17	
1st Jan.	...	1	...	4	15	14	2	36	
15th Jan.	...	3	3	...	10	12	1	29	
Total.	1	24	65	44	61	53	32	280	

Table IV.

Details of the different phases of anthesis in the six types of Chillies.

Particulars.	Actual time.						Day of opening.
	Bellary.	Nalla-padu.	Local.	Yellow.	Black.	Needle.	
1. Commencement of corolla opening.	2-00 a.m.	3-00 a.m.	4-00 a.m.	2-00 a.m.	5-00 a.m.	4-00 a.m.	1st day.
2. Separation of corolla lobes.	5-00 a.m.	6-00 a.m.	6-30 a.m.	5-15 a.m.	6-30 a.m.	6-30 a.m.	do.
3. Secretion of Nectar.	5-00 a.m	5-30 a.m.	5-30 a.m.	4-30 a.m.	6-00 a.m.	6-30 a.m.	do.
4. Recurving of corolla lobes.	8-00 a.m	7-30 a.m.	8-00 a.m	7-30 a.m.	7-00 a.m.	9-30 a.m.	do.
5. Commencement of anther dehiscence.	7-15 a.m.	9-15 a.m.	8-15 a.m.	7-10 a m.	9-00 a.m.	10-30 a.m.	do.
6. Do. in all the anthers.	8-50 a m.	9-45 a.m.	8-50 a.m	8-15 a.m.	9-30 a.m.	11-30 a.m.	do.
7. Completion of dehiscence.	10-00 a.m	11-00 a.m.	10-00 a.m.	11-00 a.m.	11-30 a.m	12-00 Noon.	do.
8. Folding of corolla lobes,	4-45 p.m.	5-00 p.m.	5-00 p.m.	5-00 p m.	8-00 p.m.	7-30 p.m.	do.
9 Opening of corolla	5-00 a.m.	6-00 a.m	6-00 a.m.	7-00 a.m.	7-00 a.m.	8-00 a.m.	2nd day.
10. Final shedding of corolla.	4-00 p.m.	5-00 p.m.	5 30 p.m.	6-00 p.m.	4-00 p.m.	6-30 p m.	do.
11 Shedding of corolla.	Night.	Night.	Night.	Night.	Night.	Night.	
12. Drying of style and stigma.	3-00 p.m.	4-00 p.m.	12-00 Noon.	4-00 p.m.	12-00 Noon.	10-00 a.m.	3rd day.
13. Shedding of style and stigma.	10-00 a.m.	7-00 a.m.	6-00 a.m	5-00 a.m.	4-00 a.m	9-00 a m.	4th day.

Table V.

Details of the Time Intervals of the Different Phases of Anthesis.

Particulars.	Date.	Time of opening of flowers.							
		2—0 A. M.		3—0 A, M.		4—0 A. M.		5—0 A.M.	
		Actual	Interval	Actual	Interval	Actual	Interval	Actual	Interval
		H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.
1. Commencement of corolla opening	29/10	5-00 A.M.	3-00	5-15 A.M.	2-15	5-30 A.M.	1-30	6-15 A.M.	1-15
2. Secretion of Nectar	,,	5-00 ,,	3-00	5-30 ,,	2-30	5-30 ,,	1-30	5-30 ,,	0-30
3. Separation of corolla lobes	,,	7-15 ,,	5-15	7-30 ,,	4-30	7-30 ,,	3-30	7-30 ,,	2-30
4. Recurving of corolla lobes	,,	8-00 ,,	6-00	8-00 ,,	5-00	8-15 ,,	4-15	8-20 ,,	3-20
5. Commencement of anther dehiscence	,,	7-15 ,,	5-15	7-15 ,,	4-15	7-15 ,,	3-15	8-00 ,,	3-00
6. do, in all anthers	,,	8-50 ,,	6-50	9-00 ,,	6-00	9-15 ,,	5-15	10-00 ,,	5-00
7. Completion of anther dehiscence	,,	10-00 ,,	8-00	11-30 ,,	8-30	11-00 ,,	7-00	11-30 ,,	7-30
8. Folding of corolla lobes	,,	4-45 P.M.	14-45	4-45 P.M.	14-00	5-00 P.M.	13-00	5-00 P.M.	12-00
9. Opening of corolla lobes	30/10	5-00 A.M.	27-00	6-00 A.M.	27-00	6-00 A.M.	26-00	6-00 A.M.	25-00
10. Final folding of corolla lobes	,,	4-00 P.M	38-00	4-00 P.M.	37-00	4-00 P.M.	36-00	5-00 P.M.	36-00
11. Shedding of corolla	,,	Night	...	Night	...	Night	...	Night	...
12. Drying of style and stigma	31/10	3-00 P.M	61-00	4-00 P.M.	61-00	5-00 P.M.	61-00	5-00 P.M.	60-00
13. Shedding of style and stigma	1/11	10 A.M.	80-00	2-00 A.M.	71-00	2-00 A.M.	70-00	2-00 A.M.	69-00

Table VI.

Details of the percentage of natural crossing.

Month.	1931—'32.			1932—'33.		
	No. of buds emasculated.	No. of buds set.	% of Natural crossing.	No. of buds emasculated.	No. of buds set.	% of Natural crossing.
Oct.	50	3	6	50	4	8
Nov.	50	4	8	50	3	6
Dec.	50	4	8	50	5	10
Jan.	50	4	8	50	3	6
Feb.	50	3	6	50	3	6
Average.			7 2			7·2

Table VII

Details of flower and fruit production.

Weeks.	No. flowers produced per plant.		No of chillies collected per plant,	
	Bellary	Nallapadu	Bellary.	Nallapodu.
16—10—32	1	7		
22—10—32	11	17		
30—10—32	22	50		
6—11—32	23	54		
13—11—32	67	50		
20—11—32	86	54		
27—11—32	72	47		
4—12—32	81	81		
11—12—32	68	30		
18—12—32	25	48		
25—12—32	32	42	...	1
1— 1—33	7	46	2	6
8— 1—33	...	37	2	2
15— 1—33	...	14	...	4
22— 1—33	...	9	3	1
29— 1—33	...	5	3	2
5— 2—33	...	3	10	7
12— 2—33	...	...	12	7
19— 2—33	...	...	...	4
26— 2—33	...	...	2	1
Total,	405	574	34	35
% of setting	6·9	5·9		

Table VIII.

Statistical details of maturation period.

Particulars	No. of Determinations.	Mean	Standard Deviation. σ	Coefficient of variation.
Bellary	64	59	±5·98	9.34
Nallapadu	33	57	±3·70	11·21
Local	35	56	±3·22	8·90
Yellow	25	60	±5·94	23·80
Black	37	57	±4·95	35·36
Needle	60	51	±3·05	15·25

A NOTE ON THE SUGARCANE LEAF HOPPER (*PYRILLA*) IN SOUTH ARCOT DISTRICT

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Introduction: This pest of sugarcane, though noted in the S. Arcot district for some years past, appeared in some appreciable numbers only last year and has this season for the first time reached the status of a major pest. It was suggested to the writer by Dr. T. V. Ramakrishna Ayyar, the Government Entomologist, Madras, that a connected record on the observations made and some work done during this year might be of some interest and this note is an attempt in that direction. It must however be emphasized that the paper has been prepared by one not specially qualified to observe from an entomological point of view, and that conclusions cannot safely be drawn until more knowledge of the pest and the damage caused by it is obtained.

CONDITIONS UNDER WHICH CANE IS GROWN IN THE S. ARCOT DISTRICT

Soil—Rotations—Manuring, etc. Cane is grown both in wet and garden lands, but this note is concerned solely with cane grown by the Nellikuppam factory in garden land under well irrigation. The soil is a sandy loam of alluvial origin. Sugarcane is grown in the following rotation ; irrigated sugarcane, rainfed cumbu (*Pennisetum typhoideum*), rainfed green manure (Sunnhemp), irrigated sugarcane. Cultivation is intensive, the full rotation taking only two years so that the land is under cane every alternate year. Manuring is heavy as in addition to the green crop which gives about 100 lbs. of nitrogen per acre, heavy applications are given of artificial fertilisers containing 150 to 200 lbs. of N. per acre. Thick varieties of cane are mainly grown, the chief of which is Fiji B (*Badila*). Harvesting extends from about the middle of January to the end of May and planting is done at the same time.

Weather: The shade temperature in the tract ranges from about 70 degrees F. in the months of December and January to about 110 degrees in the months of May and June. The average rainfall is about 48 inches. Normally about 5 inches come down in the first four months of the year, about 8 inches in the next four months which are the hottest months of the year and the rest comes down during the last four months which cover the North-East monsoon period. The rainfall figures for the present season with those of last season which was considered a good one, and also the average for the past ten years are given below :—

	Average for past ten years.	1932—33	1933—34
February	0·44″	...	...
March	0·97″	...	10·63″
April	1·40″	2·18''	0·20″
May	1·57″	2·14''	1·84″
June	1·35″	0·18''	1·31″
July	1·34″	0·35''	2·76″
August	3·93″	1·80''	3·34″
September	4·86″	6·77''	1·25″
October	10·47″	11·43''	4·29″
November	10·93″	13·42''	
December	8·70″	6·74''	
January	2·25″	...	
Total	48·21″	45·61''	

This season the weather was abnormal in that 10·50″ of rain fell during two days in the middle of March, and that September, usually a showery, humid month, was unusually hot and dry. The October rainfall was also much in defect.

Appearance and duration of the pest (Pyrilla). The pest appeared in fairly large numbers at the beginning of August, increased until early in September when the crop began to be severely damaged, and the peak was reached early in October. Since then, there has been a gradual decline, but at the time of writing (beginning of November) some blocks are still badly infested. The worst month was September when as stated above the weather was hot and dry.

Control: Control measures were initiated at the beginning of September and the following methods were tried ; spraying, light traps, bagging in handnets and egg destroying. In order to be able to get into the cane fields to carry out the control measures it was found necessary first of all to give a complete trashing.

(a) **Spraying.** The contact poison used was kerosine oil emulsion to the following formula ; one lb. of soap, one gallon water and two gallons kerosine oil, diluted with ten times water This mixture did not cause any damage to the leaves. Only a small area was sprayed but the quantity of solution calculated to be required per acre was 250 gallons. This method was not used on a large scale on the grounds of expense, difficulty of moving the sprayer about inside large blocks of cane, and because the hoppers' habit of sheltering on the undersides of the leaves made it difficult to reach them.

(b) **Light traps.** The traps consisted of small lanterns standing in trays 2 feet by 2 feet by 2 inches in which was a small quantity of oil and water. The cost of the traps was about Re. 1 each. 54 traps were in use every night for some time at a cost for oil and attention of Rs. 2—4—0 per diem, and the average number of flies caught nightly per trap was about 2,000. The traps were discontinued after a time on account of the very large number that would be required to make any appreciable reduction in the millions of flies infesting the fields. In this connection it has been noticed that, whereas the adults are attracted to bungalows at night they do not fly close to the lights but merely sit on the white walls several feet away from the lamps.

(c) **Bagging in hand-nets.** Nets about 15 inches in diameter on rattan or bamboo frames with bamboo handles were used, the cost per net being about 6 annas. Thin gauze cloth was originally used but this was found to be unserviceable and later mull was substituted which was found satisfactory. This method of control was found to be very successful and large numbers of flies were caught and destroyed by emptying them from the nets into kerosene tins containing water and a little oil. The following figures give the number of coolies employed daily, and the daily collection of flies during the seven weeks ending 4th. November 1933.

Week ending	Coolies employed daily	Flies collected daily measured in Gallons
23— 9—1933	53	28
30— 9—1933	86	42
7—10—1933	83	44
14—10—1933	50	25
21—10—1933	48	28
28—10—1933	39	22
4—11—1933	48	32½
Average	58	31½

It is estimated that with an average of 58 coolies working daily for a period of 49 days the total number of flies accounted for was 1543 gallons or about 350 millions. The flies were buried or burned at the end of each day as the smell from them if kept longer was very bad.

In netting the flies it is necessary to beat the cane in order to make the hoppers leave the plant and this caused slight damage to the tuft if done very frequently.

(d) **Destroying egg-masses.** The egg-masses of the insect are easily visible and children have no difficulty in squashing them between the fingers. Women have to be employed if the cane is tall. The children counted the masses upto each 100 as they were destroyed and a cooly in charge of each group of about 10 children marked each 100 against each child's name. In this way an easy check was kept on the number of masses destroyed. Figures for the seven weeks mentioned above were as follows.—

Egg destruction week ending	Women & children employed daily	Egmasses destroyed daily
23— 9—33.	155	603·645
30— 9—33.	123	405·408
7—10—33.	118	381·528
14—10—33.	34	89 001
21—10—33.	14	68·238
28—10—33.	14	22·414
4—11—33.	48	111·521
Average	73	240·251

During the 49 days referred to an average of 73 women and children destroyed a total of nearly 12 million eggmasses and as each mass consists of about 35 eggs, the total number of eggs destroyed is about 412 millions. The reduction in the amount of work done towards the end of the period was due to a lessening in the amount of egglaying, to an increase in parasitisation of the eggs, and the case of two weeks to showery weather and the Dipavali holidays.

Egg parasites. Two parasites have been identified by Dr. T. V. Ramakrishna Ayyar in the area, (a) Dryinid wasp (*Dryinus pyrillae*) which lays an egg in the body of the nymph, and (b) a species of small Chalcididae which parasitises the egg. The Dryinus is not present in large numbers and no detailed observations have so far been made regarding it. The egg parasite was not greatly in evidence at the beginning of the control, but increased later, and masses examined at random throughout the cane area showed the following percentage of parasitisation.

Week ending	Massess Examined	Parasitised	Not parasitised	%age of parasitation.
14—10—33.	712	526	186	73·85
21—10—33.	1486	1126	363	75·77
28—10—33.	1020	667	353	65·39
4—11—33.	3275	1615	1660	49·42

The reduction shown by the figures for the last two weeks was not unexpected as fewer parasites were seen in the fields. At this time large number of dragon flies were seen darting about over the cane, but it is not known if they were feeding on the egg parasites. Parasite breeding cages have not yet been tried but it is proposed to do so.

Effects of a severe infestation. In the case of the variety Fiji B, there is a yellowing of the foliage and a stunting of growth giving the crop a very unhealthy appearance. The upper surface of the leaves becomes covered with the sweet excretion (honey dew) of the hoppers which is later covered by the fungus *Capnodium sp.* so that the older leaves appear completely 'sooty'. In the case of Co. 213 and to a lesser extent Co. 281 there was this season a marked "browning" of the older leaves, commencing at the leaf tips, which may be associated with the infestation. The effect on the quality of the attacked cane has not yet been ascertained.

Comparative effect on different varieties. The thick cane Fiji B (Badila) has suffered the most. Co. 213 appears to be attractive to the pest but is apparently less damaged than Fiji B. Co. 281 is comparatively little attacked and E. K. 28 is even less so. The POJ varieties of which several are under trial appear to be attractive and large numbers of eggmasses can be seen on them, but in most cases the plants do not appear to be affected to any appreciable extent.

Value of the control measures. An improvement in the position, probably more due to the weather conditions than the control measures has taken place. The control work has however been done in scattered blocks surrounded by ryots' plots in which no control has been attempted, and in spite of the large number of hoppers and eggs destroyed the total population of the pest cannot have been reduced to any extent. It is realised that co-operative effort on a large scale is required to prevent plots on which control measures have been tried from being re-infested, especially as the adults are very active and at night are found flying considerable distances. It is probable therefore that the intrinsic value of the control work done this season is practically nil. The local ryots are inclined to put down an insect attack of this sort to their bad luck and to accept the position with resignation and the main idea in attempting control work was to give them a lead and show them that something can be done to fight the pest. If the work done this season results in a less apathetic attitude being taken in the case of future attacks it will have been worth while.

Acknowledgements. Acknowledgement is made of the valuable information and advice regarding the pest and its control received from Dr. T. V. Ramakrishna Ayyar, the Government Entomologist, Madras, who visited the area and who witnessed the control measures that were being done on the infested areas.

THE PERIOD OF RECEPTIVITY OF RICE STIGMA *

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Introduction. A knowledge of the natural pollination and fertilisation in cultivated crops is of extreme importance to the plant breeder in the matter of evolving successful techniques of artificial hybridisation for crop improvement. In most of the crop plants which are self fertilised, natural pollination occurs at the time of flower opening, when the anthers dehisce and shed their pollen on the stigma, which is receptive then, enabling the pollen to germinate and fertilise the ovule. In plants where cross fertilisation is the rule, self fertilisation is prevented in nature by the different times of maturity of the anther and the stigma i. e., the pollen is shed either long before (protandry) or long after the stigma is receptive (protogyny). In grasses protandry is more common than protogyny. A study of the period of pollen viability and the receptivity of the stigma forms an important preliminary work in crop improvement. The present paper deals with the studies on the period of receptivity of the rice stigma.

Review of Literature. Biffen (1905) mentions about emasculating wheat flowers and successfully pollinating the stigma a week after, proving that the stigma is receptive for a week after anthesis. Solomon (1914), experimenting on wheat to determine the relation between non-fertilisation and occurrence of open glumes, found out that in unpollinated spikelets, "the glumes remained open until the stigmas began to die, which took place in 8 to 10 days". Anthony and Harlan (1920) have reported of a systematic investigation on the period of receptivity of barley stigma. They found that "the percentage of successful pollination increased for two days. Of these pollinated 2 days after emasculation 100% of the ovaries set seed. From this time there was a gradual decrease until on the sixth day no pollinations were successful". Dietz (1928), in connection with his studies of the inheritance of rust resistance in *oats* conducted some preliminary trial to determine the best technique to be adopted in hybridisation of *oats*. His results brought out that the optimum time for pollination is after an interval of 24 to 72 hours after emasculation, both with regard to the percentage of fertility and the production of true hybrids. It is presumably based on a knowledge of this phenomenon of the prolonged receptivity of stigma that the practice is in vogue in certain countries of cross pollinating the flowers some time after emasculation. Love and Craig (19.8), in Cornell Station generally cross pollinate oat stigmas a day or two after the emasculation of the flowers. Kraus (1907) in his rice investigations at Hawai recorded his observations that "if the stigma fails to receive pollen from the anthers of the same floret, foreign pollen may fertilise it even after a considerable interval. About hybridising rice, Jenkin Jones (1929), from California, Rodrigo (1925), and Torres (1923), from the Phillipines, report that after emasculating the spikelets, the stigmas may be pollinated the same or the next day.

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So far as the writer is aware no systematic study has however, been reported about the period of stigma receptivity in rice.

Method of work. The series of artificial hybridisations in connection with this study were conducted during flowering seasons, 1929-30, and 1930-31. The procedure of study adopted was to emasculate a number of spikelets a few hours before their normal opening time, to pollinate them on the same day or at one day intervals on successive days and finally to compare the receptivity of stigma by the percentage of set seeds obtained in each pollination. The technique of hybridisation followed was the one practised all along in the Paddy Breeding Station at Coimbatore with good success (Ramiah 1927). The method adopted in Japan, Java, Phillipines and California viz., of clipping off the upper half of the fertile glumes before emasculation, was not followed as the set seeds obtained in this way are easily liable to be damaged by external agencies and at least some of them rendered non-viable since they are but partially protected by the glumes. Rodrigo in Phillipines appears to employ some nutrient medium to germinate the hybrid seeds after they are sterilised whereas no such procedure is adopted in Coimbatore. Only five to twenty five per cent success is claimed by the method of clipping the glumes. As the results in the accompanying table will show, the method adopted at Coimbatore has given better results, when the pollinations are done at the optimum condition of the stigma, as for instance till the fourth day after anthesis. The emasculation method advocated by Sharangapani (1924) i. e., to tie up the emasculated flowers with silk thread was also not adopted for this experiment, as the process would naturally restrict the number of spikelets that could be operated on in a short period of interval, whereas, for the present study, the larger the number of cross seeds obtained the greater should be the accuracy of the results.

There was no difficulty in choosing the materials for the crosses from among a collection of over 600 pure lines of rice grown year after year in the station. In selecting the two parents for each set of cross a non-pigmented type was chosen as the female and one with anthocyan pigment on the leaf sheath as the male so that the success of pollination of each grain could be confirmed even in the early stages of the seedlings raised from the crossed seeds, from the presence of pigment on the leaf sheath. Care was also taken to see that the blooming periods of the two parental types synchronised as closely as possible, so that fresh pollen could be procured in abundance from the male parent.

For each set of cross, half a dozen plants true to the type were chosen as mother parents and in each of them only the spikelets of the first three tillers were operated upon for the study. Each panicle was considered to be a separate unit for pollination instead of the entire plant and a sort of randomisation was adopted for emasculating and cross pollinating the spikelets of the different panicles on different dates i. e., within the same plant the three different panicles would have been emasculated on different dates and pollinated at different intervals after emasculation. A scheme was drawn up beforehand and the emasculation and cross pollination of spikelets of each tiller were carried out according to the scheme. The panicles were properly labelled after emasculation and cross pollination. For emasculation on a particular day, only the spikelets that would open that day were chosen and those are easily discernible to a trained eye. A panicle takes 5 to 6 days for completing the blooming of all the spikelets in it and for this experiment the panicles were treated on the 2nd or 3rd day after the starting of anthesis, as the maximum number of flowers open on these days. Besides, the later blooming flowers in a spikelet were purposely omitted, as unsetting in rice, even under natural condition is mainly confined to these spikelets (Ramiah 1931). Artificial cross-pollination was always effected at the time of the natural anthesis of the male parent so as to ensure the maximum viability of the pollen. When the grains were ripe the panicles were separately harvested with the respective labels and the set and unset grains carefully counted under each set of pollination. The set grains of all the groups were then separately preserved after giving them two or three dryings in the sun and they were sown in seed-pans on a subsequent date to ascertain the success of the cross pollination.

Results and Discussion. The results of the different sets of artificial cross pollinations are set forth in a table below.

Table I

Showing the percentages of setting of grains when cross pollinated at different intervals after emasculation.

Time of Cross pollination.	T. 40xT. 130			T.430xT.137			T. 63xT. 344			T. 30xT. 341			Total		
	Set.	Un-set.	%set.	Set.	Un-set.	%set.	Set.	Un-set.	%set	Set.	Un-set.	%set.	Set.	Un-set.	%set.
Same day of emasculation	10	33	23·3	11	15	42·3	...	...	...	26	4	86·7	47	52	47·5
One day after emasculation	23	70	24·7	0	11	0·0	...	...	...	38	5	88·4	61	86	41·5
Two days after emasculation	19	40	32·2	8	16	33·3	4	13	23·5	16	5	76·2	47	74	38·8
Three days after emasculation	26	38	40·6	19	35	35·2	4	19	17·4	26	8	76·5	75	100	42·9
Four days after emasculation	4	20	16·7	1	35	2·8	4	13	23·5	9	9	50·0	14	77	15·4
Five days after emasculation	...	...	...	0	24	0·0	2	12	14·3	1	5	16·7	3	41	6·8
Six days after emasculation	...	...	...	...	...	...	...	...	...	4	4	50·0	4	4	50·0
Seven days after emasculation.	...	...	...	...	...	...	...	...	...	0	8	0·0	0	8	0·0

Except for the occurrence of a few non-crosses among the first day pollinated spikelets, the set grains obtained from all subsequent pollinations proved to be true hybrids. In cross No. 3 the programme of pollinations on the first two days could not be carried out on account of some unavoidable circumstances. For that particular cross, therefore, only the results of pollinations at subsequent intervals are given here. In cross No. 2, the complete failure to set, when pollinated one day after emasculation is inexplicable. Grouping the results of all the crosses together, the percentages of setting under the different sets of pollinations are represented by a graph below.

Graph. There is no uniformity in the percentage of setting at corresponding intervals of pollination in the different sets of crosses. This is partly due to the varietal differences with regard to their ease of manipulation. In some rices, specially, where the glumes are broad, emasculation is comparatively easier and hence they give a greater percentage of set grains in hybridisation. However, it can be seen from the graph that the rice stimga retains a fairly high degree of receptivity for three days after the natural opening of the flowers and that later on, the receptivity gradually diminishes until it is completely lost by the seventh day. The high percentage of setting on the sixth day after emasculation in cross number 4 is not quite reliable as the number of spikelets cross pollinated in that particular case was rather small viz., 8.

It is needless to stress on the limitations of this experiment, the results of which are judged purely by artificial hybridisation by mechanical means, as it is well known that atmospheric factors like temperature and humidity play a very important role in the natural opening and pollination of flowers. These are of course, beyond control under ordinary field conditions. Fortunately however, the atmospheric conditions remained favourable during the course of the experiment, as bright weather prevailed throughout this period. The uniformity of skill and care exerted during the crossing operations is another important factor affecting the reliability of the results. This error due to personal factor may however be taken as uniformly distributed over all the sets of emasculations and cross pollinations, as these operations were all done entirely by the writer himself exercising equal amount of care throughout. The limited number of spikelets that could possibly be handled formed another handicap in this investigation. This is due to the short period of 4 or 5 days within which the spikelets of the primary tillers of a pure line of rice complete their flowering phase. A tiny caterpillar which used to damage the emasculated flowers by eating away the stigmatic tissues was another source of trouble which contributed to the reduction in the number of emasculated flowers available for cross pollination.

Summary and Conclusions. The degree of receptivity of rice stigma is reckoned in this study from the percentages of setting exhibited by spikelets which were emasculated one to two hours before the time of their natural opening and cross pollinated on the same day or at one day intervals upto 7 days. Four different sets of crosses were done in connection with this investigation. Although the percentages of setting in the different sets of crosses are not uniform at the corresponding intervals of pollination, it is fairly evident from the data, that for the first three days after the natural opening of the rice flowers, their stigmas maintain nearly as high a degree of receptivity as on the first day, but gradually lose it afterwards until on the seventh day the receptivity is completely lost.

The results obtained from the present study are of importance for the rice breeder in his artificial hybridisation work in the following ways :—

1. In case two parental types differ in their flowering durations by not more than a week, cross pollination may be effected between them by bagging the emasculated spikelets of the earlier variety and cross pollinating them with the later one within six days after

emasculation, although the percentage of set grains thus produced may be somewhat reduced.

2. If, after emasculation of spikelets, unfavourable weather conditions or some other external disturbances do not permit of immediate cross pollination, the latter operation can be safely postponed for two or three days with full confidence of obtaining the same amount of success as can be had by pollination on the same day of emasculation.

3. Cross pollination done one or two days after emasculation is of decided advantage in hybridisation work, as the set grains obtained in this way are sure to be hybrids, as any self fertilized flowers among the emasculated spikelets can easily be detected even the next day after emasculation, from the withering condition of their stigmas and slight enlargement of their ovaries and can thus be rejected then and there.

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MULBERRY CULTIVATION IN KOLLEGAL AND THE SERICULTURAL INDUSTRY

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The cultivation of mulberry is simple and may be done in a wide range of climate and soil provided the latter is fairly fertile; the rearing of silkworms is however possible only in temperature ranging between 70° to 90° F. with a humidity of 50 to 70%. During the hot weather the rearing is as a rule stopped and the bushes pruned for a fresh flush of leaves. The above named conditions exist in the Kollegal taluq almost throughout the year and hence the rearing of silkworms is carried on all the year round giving occupation for well over 5000 families in 36 villages, the mulberry crop being raised on 10,000 acres and raw silk to the value of 10 lakhs of rupees being exported from this taluq.

Soils. Red sandy loams, black cotton soil and even sandy and gravelly soils are found suited to the growth of mulberry.

Varieties. Bush mulberry or the white mulberry (*Morus Indica*) is the only species grown in Kollegal. The varieties known locally as the *Ennairangina gaddi* and the *Buddigaddi* are popular on account of the better and more nutritious leaf they give while the variety known as the *Karigaddi* is also to be found here and there.

Propagation, planting etc. The crop is propagated by cuttings. The land is ploughed 6 to 7 times in April and May; 15 to 20 cartloads of cattle manure per acre are applied and spread before the final ploughing. The cut bits are planted with the first showers of the South West Monsoon. Furrows are opened 2½ to 3 ft. apart either way and at the junctions holes 1 foot square and 6″ deep are made and in each hole 2 to 3 cuttings are planted; 4 to 5 headloads of fresh cut bits are required to plant over 1 acre. If the weather is moist and cloudy the cut bits keep for 4 to 5 days. The bits are 8″ to 9″ long with 3 nodes in each and are laid flat like sugarcane setts. When necessary as during dry hot weather, one or two hand waterings are given. Young shoots appear in two months after planting. At this stage, weeding and intercultivation are done by working guntakas. Once a month for the next 7 or 8 months this intercultivation is carried on, every time after the picking of the leaves.

List of implements with a cultivator whose holding is 5 acres in Kamakarai Village :—

1 plough	1—0—0	1 *Ujjari*	0—4—0
1 *Balguntai*	1—2—0	1 Kalkat	0-10—0
1 *Tadiguntai*	1—2—0	Barkani 1 pair	0—2—0
1 *Kiriguntai*	1-12—0	Murrels	0—2—0
1 *Machu*	0-10—0	Yoke and rope	1—8—0
		Total...	7—4—0

Initial cost of planting 1 acre of mulberry.

4 ploughings at 12 annas each	Rs. 3—0—0
15 cartloads cattle manure	7—8—0
Carting	3-12—0
Spreading	0—8—0
Opening furrows for planting	0—8—0
Setts 4 bundles for planting	1—0—0
Cutting setts and carrying	0—8—0
and preparing	0—8—0
Planting setts—10 women	1—4—0
2 Weedings—6 women each time	1—8—0
Hoeings—twice a month for 8 months	4—0—0
Total.	24—0—0

Recurring charges including assessment.

Assessment varying from 0—12—0 to 1—5—0.	Average	1—0—0
Two ploughings at 0—8—0 each	,,	1—0—0
24 hoeings a month at 0—8—0 a pair doing 2 acres a day	,,	6—0—0
Pruning—2 men	,,	0—8—0
Manure—7 cartloads at 0—8—0	,,	3—8—0
Carting	,,	1—8—0
Weeding—6 women	,,	0—12—0
Applying manure to the pits	,,	0—8—0
	Total.	14—12—0

The mulberry leaves are easily browsed by sheep, goats and cattle and the fields should therefore be carefully fenced. Plantations ordinarily keep going for 12 years after which the bushes are pulled out and sown to annual crops like ragi or cholam for 1 year and again planted to mulberry. From 6 to 8 cuttings may be had of an acre of mulberry, 30 headloads or 3000 lbs. of leaves being obtained from each cutting.

Life history of silkworms:—The Kollegal silkworm belongs to the multivoltine or polyvoltine class that pass through a number of generations in a year. Polyvoltine worms feed on all bush mulberry leaves and it is perhaps difficult to rear them on tree mulberry leaves because of over-nutrition. The silkworm lays on an average 250 to 350 eggs which are oval in shape and very minute measuring about 1¼ m. m. by 1 m. m They are cream-coloured to yellowish white when freshly laid but turn bluish black just before hatching. At Kollegal the eggs hatch out in 10 days; this period may be shorter or longer according to the temperature of the locality. In the hot months (April and May) hatching takes place in 8 days. The new hatched out worms are minute in size 2 m. m. long with a slender more or less elongated cylindrical shape. The worm is at this stage fringed with tufts of fine hairs; its color is dark brown, the head being black. The body is composed of 12 segments or rings. Behind the head there are 3 segments wherein are the front legs and the thorax. The remaining 6 segments constitute the abdomen and here are 5 pairs of legs. The head is composed of 2 scaly parts and is fairly uniform. There are 6 small single eyes. In the middle of the upper lip is a little elongated tubular organ with a microscopic orifice called the 'spinnaret'. The body contains 2 silk glands which open out into this orifice. When the larva approaches maturity these glands are filled with a clear viscous fluid which is thrown out through the orifice. When this fluid comes in contact with air it solidifies and forms the lustrous fibre called 'silk.' The thread thus formed really consists of 2 filaments one from each gland which have become agglutinated. The color of the legs generally indicates the color of the cocoons and the silk thread. The length of fibre that each vomits is from 300 to 1000 yards. The moths that emerge out of the cocoons are creamy white in colour. The male moth is smaller than the female. Both have the wings developed but they never fly. The male moth is smaller and more lively. Its antennae are long and blackish in color, while those of the female are only slightly developed.

Rearing of silkworms. The main object in rearing silkworms is to get good cocoons yielding good quantity and proper quality of silk. To produce 2½ maunds (1 maund = 25 lbs.) of cocoons or 10 trays, the following appliances were used by Basava Chetty at Kamakarai.

1 Stand	2—0—0	1 lamt	0—0—6
10 Trays	2—8—0	Litter baskets	0- 1—6
1 Sickle	0—6—0	4 Ant-wells	2—0—0
2 Baskets	0—2—0	Chopping Board	0—2—0
2 Bags for bringing leaves	1-12—0	10 Chandrikes bamboo trays	5—0—0
			14—0—0

Rearers usually buy seed-cocoons from vendors at Kunigal or Bidadi in Mysore State at Re. 1 per 1000 cocoons when paid in cash or Rs. 2 per 1000 on credit. One maund of cocoons count about 14,000 and cost Rs. 7. These cocoons or seeds are placed in bamboo trays and kept safely on a bamboo stand in a ventilated room. The moths coming out of these cocoons are usually half male and half female in number. As soon as they emerge, each male moth pairs off with a female. After 8 hours of mating the female moth is separated from the male and kept in separate bamboo trays for laying eggs. The newly laid eggs (250 to 350 per moth) are covered with a viscous fluid and so stick on to the surface where they were laid usually a piece of newspaper. Within three days, the eggs are all laid and the female moths are all thrown away—the same fate which the male moths suffered earlier in their career, i. e. after their separation from the females.

The eggs are kept in the same trays over the stands with great care. They hatch out in 10 days. The young larvae are usually brushed on to a fresh tray with a fine feather, and are fed with tender finely chopped mulberry leaves. For each feeding fresh leaves are picked from the plantation.

Feeding and moulting. The life of the worm from hatching time to spinning of the cocoon is 30 days in summer but slightly longer during the cold months. These worms in common with many others moult periodically as they feed and grow. Since they moult four times during this period of 30 days the periods of activity may be said to be five.

The table below shows the interval of each period, number of feeds, quality of leaves etc.

Period.	Number of days.	Number of feeds in 24 hours.	Moulting period.	Quality of leaves supplied for feeding.
1st	7	8	36 hours	Tender leaves finely chopped.
2nd	4	7	24 ,,	Half mature leaves chopped a bit coarser.
3rd	5	6	24 ,,	Half mature leaves chopped much coarser.
4th	6	5	36 ,,	Three quarter mature leaves, each leaf chopped into 3 or 4 parts.
5th	8	4	Spinning.	Fully mature leaves fed entire.

Moultings are periods of inactivity when the worms lie inactive and eat nothing. With every moulting the old skin is shed off. The worms should not be disturbed during this period. When the worms get out of their moults their stomachs are delicate and so fairly tender leaves should be given for at least 2 feeds to allow of easy digestion.

Cleaning the litter. The worms do not eat all the leaves that are given to them. They should be removed at least once a day to new trays and the litter collected and thrown away in the manure pit.

Spacing of worms. The worms grow bigger in size day by day and hence greater space is necessary for them. The eggs laid by 500 mother moths when hatched occupy only quarter of a tray but during the spinning stage the adult worms occupy 25 trays i. e. they require 100 fold space. When the worms mature which is recognised by their transparent yellow colour they are collected and sprinkled over in *chandrikas* or spinning trays. Each tray of worms is given space in 1 *chandrika* for spinning. This tray is kept in the open exposed to the morning sun. They are left thus in the trays for 2 days when the cocoons are gathered and sold away in the green state and reeled off into silk.

Rearing room. Generally the courtyard, verandah, sleeping room and even the cattle yard is used as a rearing house, here the bamboo stand is placed and trays arranged on them. The eggs, worms and cocoons are safely guarded against ravages from rats, lizards, birds and ants.

Diseases of silkworms. The chief disease is the "*Pebrine*" an infectious disease. The disease is characterised by the black spots which appear on all parts of the body especially tail, legs and back. The attacked worms remain small, languid, eat little and succumb between second and third moult. There is no cure for the disease; the affected worms must be burnt to prevent infection.

Flacherie. This is a bacterial disease caused by indigestion. The worms become lean and thin and sometimes vomit green fluid matter from their mouths and void semi-fluid faeces. The disease is contagious and is virulent in summer. The worms spin cocoons if the disease is not acute, but they die and decompose within the cocoons.

Grasserie. This is mostly due to careless feeding first with mature leaves and then with tender or succulent leaves after a rain. This may also be due to exposure of the worms to damp and cold air or sudden change of temperature. The disease is not infectious. Wet leaf and damp air should be avoided. This disease is not of common occurrence in Kollegal.

Muscardine. This is a parasitic disease caused by a fungus. The infected worms are quite stiff after death. The dead worms should be burnt immediately. Good ventilation and light should be maintained in the rearing rooms. This is rarely seen in Kollegal tract.

Economics of mulberry cultivator. About 80% of the cultivators rear their own worms. Others sell the plantation as a standing crop to other rearers. A plantation is usually kept for 12 years with an initial expenditure of Rs. 24 and a recurring charge of Rs. 14—12—0 per acre every year. The average cultivation charges per year come to Rs. 15—8—0. The yield of leaves on an average is 3,000 lbs which at 12 annas per headload of 100 lbs works to Rs. 22—8—0. The net gain per acre is thus Rs. 7—8—0. The interest on the value of the land which varies from Rs. 20 to Rs. 150 per acre has been ignored in the above calculation.

A ryot rearing the worms himself out of the leaves from 1 acre may raise 6 crops.

The table below shows the quantity of leaves from pruning, to pruning, the number of seed cocoons, the number of trays of worms, wages of labour employed etc.

Crop.	Headloads. of 100 lbs.	Seed cocoons.	Trays.	Labour.
1	10	700	8	2—8—0.
2	5	250	4	1—2—0.
3	5	250	4	1—2—0.
4	3	200	2	Nil.
5	2	100	1	..
6	8	500	6½	2—4—0.
		Oil		2—4—0.
		Seed cocoons		2—8—0.
	33	2000	25½	11—12—0

Twenty five trays of worms will yield 6¼ maunds of cocoons which at the present rate of Rs. 6 to 7 per maund works out to an average of Rs. 40. Since the leaves and the labour are the ryot's own he realises about Rs. 40 when he sells the cocoons. If the leaves are valued and the labour as well, he makes only Rs. 5 or even less; the industry is not therefore in a very good condition. If the price of cocoons would go up to Rs. 10 per maund the ryot may hope to get about Rs. 65 and there will be a net profit of Rs. 30 per acre. The fall in the price of cocoons is in the opinion of the writer, due to the dumping in of silk from China where the cost of production is far lower on account of the existence of tree mulberry there and other natural facilities. If the Government could give protection to the silk rearers of India by prohibiting the import of foreign silk into India there is some hope for the survival of the old indigenous industry which is the source of livelihood for about 5,000 families in this taluq.

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Notes & Comments.

The New Year 1934. The year 1934 would have come into existence by the time this issue of the Journal reaches our readers. For the Journal another year of service will begin. The present period is one of unusual depression and the stars aspect the agriculturist with a malignity. The produce of his labour sells very low. The unending jugglery in monetary values continues. Meanwhile population increases and the need for food and other commodities behind all industry, continues the more insistent. The agriculturist has to continue in his calling. He needs help and will continue to need it. May this little Journal serve to further the cause of the noble calling of agriculture!— is the prayer with which we appeal to our members to continue and enlarge their support to this Journal.

Agrarian Relief. The United Provinces Agricultural Relief Bill is a sound measure calculated to alleviate some of the many ills which an agriculturist is heir to. The chronic indebtedness of the Indian agriculturist is a well known fact and his social setting and traditions are such that there is no near prospect of his mending his ways. Preventive measures are thus remote and the only sympahy that can be shown to him is to enact measures likely to cure his economic diseases. The present economic depression has all the world over hit the agriculturist most. The wide agrarian unrest, rumblings of which are heard even in Madras needs sound and sympathetic handling and we hope and pray that this passing phase may prove a blessing in disguise.

Development of Silk Industry The world produces about 150 million lbs of silk. Of this Japan monopolizes well over half. China and Italy come next. India produces about 2¼ millions and of this, Mysore produces half. Next to agriculture sericultune is the most important industry and the Mysore Assembly is to have a member representing the silk industry. In Mysore more than 5 lakhs of persons are supported by silk and the revenue it brings to the State is about a crore of rupees. The economic depression and the dumping of cheap foreign silk, natural and artificial, has created a serious disturbance in the silk industry and measures designed to alleviate this trouble were discussed at the recent conference at Chennapatna in the Mysore State. The delay in giving the much needed protection by the Tariff Board was deplored and quick action urged. Measures calculated to higher efficiency in production and greater co-ordination in the trade and industry were discussed. It was decided to suggest the inclusion of sericulture in the activities of the Imperial Council of Agricultural Research. Nearer home, the possibility of inducing a greater use of silk by the common folk as in China, was to be explored. A factory for waste silk was needed badly. We in Madras have our sericultural interests equally at stake and it is up to us to profit by these activities in Mysore.

The Science Congress and the Imperial Council of Agricultural Research. The Indian Science Congress will hold its twenty-first session at Bombay in January 1934. This Congress has an Agricultural Section in which papers of Agricultural importance are read and discussed. The Imperial Council of Agricultural Research is interested in agricultural improvement and takes opportunities of having joint consultations on aspects of improvements at the various sectional meetings which it holds. The old Board of Agriculture meetings are getting sparse, so much so that the Agricultural section of the Science Congress seems to be the only annual gathering of a comprehensive character bringing together scientists of varied interests to further the cause of agriculture. Owing to financial depression there is a tendency in recent years of Agricultural Officers from the provinces to be deputed to attend the Congress in lesser and lesser numbers. We take this opportunity to suggest to the Imperial Council of Agricultural Research the desirability of their sympathetically considering the question of giving small lump grants to the provinces to enable them to meet either in part or in whole the expenditure involved in the deputation of its Agricultural Officers to participate in the deliberations of the Agricultural Section of the Indian Science Congress.

Cattle breeding. The Improvement of cattle is of vital importance to Indian Agriculture and should go hand in hand with improvement along other lines. Cattle are the back-bone of the cultivator. The two wings of the Imperial Council of Agricultural Research—one for Agriculture and another for Animal Husbandry are a token of this importance and as such sound policies have to be laid down and steadily pursued in this vital work. If errors have been made, lessons have to be learned from such errors with a view not to repeat them. The experiment in the cross-breeding of the local breeds with foreign stock which in Madras reached in 1919 the stage in which half-breds were mated to half-breds, was closed down during this year. It was noticed that there was a steady decline in all the desirable qualities that in the first generation gave rise to hopes in this line of improvement. Fourteen years have gone by and the present generation is being " served by Scindhi bulls in order to breed back to the country herd ". In this connection we invite the attention of our readers to the illuminating evidence of Mr. Bruen, Livestock Expert to Government of Bombay, before the Royal Commission on Agriculture stressing the desirability of improving local breeds in clear preference to cross-breds (vide Report of the Royal Commission on Agriculture Vol. II, Part I pages 414-5).

The Ongole breed of cattle are of international reputation and have been much sought after in other countries for their superior qualities. This breed is the premier breed of Madras. The Livestock Research Station at Chintaladevi has been closed down as a measure of retrenchment and a select herd has been transferred to Hosur. The Director of Agriculture in his current Annual Report says "There is very little demand for this breed at Hosur and the animals themselves do not thrive well in the tract. It has been decided to discontinue maintaining this breed here". This is a sad end to an important line of work and it is hoped that with the passing away of the financial depression one of the first endeavours of the Department will be to begin again work on this breed at a suitable centre in the Ongole tract. Cattle improvement is a slow work involving generations of sound endeavour and can ill-afford to have breaks of this kind.

The Indian Sugar Committee. Coimbatore had the honour of a visit from the members of the Sugar Committee of the Imperial Council of Agricultural Research, who met in conference this time at the Sugarcane Breeding Station, the centre from which improved Sugarcanes are distributed throughout India. As a result of protection, the number of factories has already increased and a very big increase is naturally expected in the coming years. This will automatically result in an increased growing of sugarcane. Foreseeing the inevitable clash between the interests of the grower and manufacturer, the Committee recommended legislation by which the price paid to the grower would be linked up with the profits made by the sugar factory. This is a difficult task, but other sugar producing countries have achieved this and with the freedom given to the provinces, they can each act to suit local needs. The Committee approved of schemes for research into the chemistry and anatomy of sugarcane and sanctioned the establishment of a central institute for sugar research. There are many aspects to the sugar problem and such an institute will be able to co-ordinate the various lines into a harmonious whole. The problem of molasses disposal is a chronic one and the Committee decided to carry out preliminary experiments on the problem of the production of power alchohol and blending it as motor fuel with petrol and legislate for this combination and trial in a restricted area. The sugar industry is now growing under the safe wings of protection, but measures to utilize waste and bye products will help to stabilize the industry and enable it to face world competition, if and when protection is withdrawn. We wish the Committee all success, in this comprehensive scheme of help that it is planning on behalf of this great industry.

ABSTRACTS

The effect of Mechanical seed injury on the Development of foot rot in Cereals. By J. E. Machacek and F. J. Greaney. (*Canadian Jour. of Res. Vol. 8, No. 3, p. 276—281*). Greenhouse and field experiments have shown that the use of mechanically injured seed promotes the development of seedling blight and foot rot caused *Fusarium culmorum* in cereals, thereby retarding the growth of the plant and decreasing yield.

Discussion. The mechanical injury of seed appears to be an important factor in the development of pathologic conditions other than the foot rot caused by *F. Culmorum*. The investigations of Hurd and Wallden show that mechanically injured seed is particularly susceptible to invasion by saprophytic fungi. Hurd found that mechanical injury lowers seed vitality, although germination may be unimpaired. If favourable conditions are present, the injured seed, though its initial germination is good, soon becomes invaded by saprophytic fungi, the invasion resulting in distortion and stunting of the seedlings, and often in lessening of the coleoptile and primary roots. Hurd believes that the seed testa protects the seed from fungous invasion, and that, if the test is broken, the nutrients contained in the endosperm become readily available of these fungi, resulting in their luxuriant growth when conditions of temperature and moisture permit. Consequently according to her findings, mechanical seed injury as well as other factors that lower vitality of seed grain predispose the seed to invasion by fungi.

It is probable that the same host-parasite relationship exists in the development of *F. Culmorum* foot-rot in cereals. Through mechanical injury of the seed the endospermic nutrients become readily available to the fungus, thereby promoting its growth, but at the expense of seed and seedling. That this theory is at least partly correct is shown by the examination of the greenhouse experimental data. A considerable number of seedlings failed to reach the soil surface when injured seed was planted in infested soil, whereas injured seed produced seedlings that, under similar conditions, were able to emerge from the soil in large numbers. The possible increased growth of the fungus in the case of the injured seed, is directly reflected in the rapid development of pre-emergence blight. It would therefore seem probable that the use of uninjured seed would be advantageous to the farmer in his attempt to produce a disease-free crop.

Nitrogen Accumulation in soil as Influenced by the Cropping system. T. L. Lyon and J. A. Bizzell, pp. 266—272. (*Jour. of American Society of Agronomy. Vol. 25, No. 4, April 1933*). The kind of crop grown immediately preceding another appeared to be a more important factor in determining the yield of nitrogen in the succeeding crop than was a previous gain or loss of soil nitrogen, at least where such differences were large. The influence of the preceding crop appears to be caused through its effect on the availability of soil nitrogen. In the case of alfalfa this was very great.

Saugkraftmessungen an Baumwollsorten. *(A translation).* By E. Taschdjiam. (Osmotic pressure determinations in Cotton Fortschr. Landw. 1928 : 159-60.) On the ground of osmotic pressure determinations on 25 cotton varieties of Egyptian and American origin the following relationships can be deduced :- 1. Varieties with high osmotic pressure, have correspondingly long staple, transpiration conditions being the same. II. The yield in dry climates depends upon the osmotic pressure. Higher osmotic pressure are associated with higher yields. III. With increasing osmotic pressure of the variety the number of shedbolls falls. IV. With increasing osmotic pressure the germination is quicker and more uniform. This is of importance in practice in that the stand in the field is more uniform, the harvest is accomplished more rapidly and the plants are less damaged by fungus attack. V. With increasing osmotic pressure the length of life falls, the genus and transpiration being the same. From this it follows that the danger of forest damage is less in early varieties. VI. With increasing osmotic pressure the growth is lower and the resistance to damage by wind etc., is less, within the same genus. VII. With increasing osmotic pressure the resistance to boll weevil rises. VIII Varieties with higher osmotic pressure are more suited to dry soils, transpiration being equal. These relationships will enable important practical results for cotton cultivation to be obtained when the investigations are continued with still more extensive material.

The Root-Knot, Hetorodera radececola (Greeff) Muller of Tomato and other plants in the Philippine Islands. By Fajardo T. G. J. Palo M. A. 1933. *The Philippine Journ. of Science 51--4 (457--481).* In this paper the authors present the results of a comprehensive study of the Root-Knot nematude problem in the Philippine islands. As a result of a general survey of the nature and extent of the malady, the widespread prevalence of this root inhabiting organism attacking as it does such economic crops as Sugarcane, Tobacco, Tomato, Cowpea, Beans Abaca, Pepper etc. is brought into prominence The climatic and other conditions of the country being quite conducive to the unhampered activity of the parasite the authors rightly sound a note of warning regarding the growing menace and potential danger from this pest to Agriculture of the islands. They proceed to give an account of the principal observations on the parasite. As external morphology and the effects on the host including the physiological disturbance of the host plant and the resultant symptoms on the aerial and underground portions of infested plants. The general external morphology of the several stages of the causal organism are briefly outlined. From certain cross-inoculation experiments it has been concluded that there exists no distinct biological strains of the nematode. It has been observed that any moisture conditions capable of sustaining plant growth are equally suitable for the continued activity of the organism. The effect of loading of infected soil is found to yield beneficial results in that the nematode population gets considerably reduced. Air dessication of such soil also produced equally beneficial results. The total elimination of the worms from such soil may be effected provided the period of treatment is sufficiently long, the minimum period recorded being 30 to 35 days under the meteorological conditions of the country. But this is a factor subject to great variability being dependent upon the proportion of initial moisture in the soil experimented with.

Laboratory experiments on the sensitiveness of the larvae to complete dryness revealed that the earlier stages are less able to withstand dry conditions than the older ones. All stages were killed within a period of 10 to 15 minutes of drying in the laboratory while the newly hatched larvae were killed much sooner i.e. within three minutes. On the other hand the larvae were observed to be more tolerant to moist conditions without food than to dessication and a small percentage managed to be alive under these conditions for a maximum period of 30 days. No seasonal changes in the activity of the organism have been noted by the writers under the climatic conditions obtaining there. Numerous trials regarding the relative susceptibility or resistance of different varieties of Tomato to nematode infection exhibited no appreciable difference. The Host range of the organism is tentatively defined and about 23 economic plants are listed under the category. A few resistant ones such as rice, corn, garlic, onion, peanuts have also been recorded which may be of great use in the rotation of crops. The paper concludes with a discussion of some well-known control measures advocated all the world over.

The paper presents results which throw light on the biological peculiarities of the parasite Despite the large amount of work done in various parts of the world the problem of its control still remains unsolved. Any investigation, therefore, that might tend to elucidate the bionomics of this notorious pest will be of utmost value. The correct name of the nematode (according to the international rules of zoological nomenclature) appears to be Heterodera marioni (cornu) Goadey. (Goadey 1932—Journ. Helumithology 10, 21—28) P. N. K.

Gleanings

"A Banana Recipe Booklet" It is true that the banana, eaten in an unripe state, will, in common with all fruits, cause intestinal disturbance to a greater or less degree. The ripe banana, however, is not only a fruit of remarkably high food value, but is amazingly easy to digest. It can be eaten with safety and relished by every one from infancy onwards. No fruit compares with the ripe banana in food values; no fruit approaches it in regard to digestibility and easy assimilation; no fruit and very few foodstuffs approach it in regard to value for money expended. Writing of the banana, Professor S. C. Prescott (Massachusetts Institute of Technology) says: "The ripe banana contains all the classes of food materials required for the human body. Although the amounts of protein and fat are slightly too low to constitute a perfectly balanced ration, the combination of bananas with milk, or its utilization to supplement a diet containing a small amount of meat will produce a ration which is ample to take care of the body needs." (Agricultural Gazette, New South Wales, Vol. XLIV, Part II, November 1933).

Genetic factors for pigmentation in the onion and their relation to disease resistance. By G. H. Rieman. *Summary.* In an attempt to make a genetic analysis of the relation of the red, yellow and white color classes to disease resistance in the common onion, data involving a classification of not less than 330 progenies and approximately 22,000 individual bulbs are reported. An interpretation of the results obtained in the F-1 to the F-4 generations of the various genetic tests employed, requires five different genes governing bulb pigmentation as follows:—

(1) I gene for incomplete inhibition of color. (2) I gene allowing expression of color. (3) W gene for red pigment. (4) Wy gene for yellow pigment. (5) W gene for white.

The inhibitor of color, gene I, is dominant to its recessive allelomorph 1. The heterozygous factor, pair 11, produces red-neck and cream-colored bulbs in the presence in the color genes W or Wy. Independent inheritance is demonstrated between the allelomorphic pair Ii and the genes for color.

The gene for red, W, is dominant to the gene for yellow, Wy, and the gene for white, W. It is assumed that the gene W is allelomorphic to the genes Wy and W. The relation between genes Wy and W has not been demonstrated.

The gene W and Wy are responsible for the production of a toxic substance, protocatechuic acid, in the other scales of resistant onions.

The color-inhibitor gene, I, interacts with the gene for red,W, producing intermediate resistant bulbs. (J. Agri. Res. Vol. 42, No. 45 pp. 276—278).

2. **Effect of wind on plant growth,** H. H. Finnell. (Jour. Amer. Soc. Agron., 20 (1928), No. 11, pp. 1206—1210, figs. 4). Statistical analysis having indicated a greater damaging effect from high wind than increased transpiration alone would seem to justify, simple pot tests were devised and carried out with mari-golds as the tender foliage plants, using wind at 15 miles per hour as the sole variable factor to be studied. The preliminary results are herein presented.

A portion of the tender foliage was destroyed by the whipping of the wind, deformation of the main stem was marked in early growth stages, and the rate of growth in height was immediately reduced. The time of maturity was lengthened by wind about 10 days for a 60 day period. Yield of dry matter was reduced 48·8 per cent. by wind. Total water requirements per plot did not vary significantly. Water requirements per unit of dry matter produced were approximately doubled by exposure of plant and pot to wind, which also apparently increased the number of secondary branches formed by 42·8 per cent. (Agricultural Botany page 725).

Autumn Leaf Colors. Gorgeous autumnal colors in woods and along roadsides are due to two general classes of chemical compounds in the aging leaves: carotinoids and anthocyanins. The carotinoids are responsible for the yellows and the anthocyanins for the reds of purples.

Dr Charles E. Sando, of the U. S. Department of Agriculture, has summarized the process by which leaves turn from green to grey, when promises of frost begin to cool the air. Carotinoid pigments are present in all leaves, but are masked most of the time by the abundant green coloring matter, chlorophyl. Chlorophyl is always being both formed and destroyed in leaves, but in autumn destruction goes faster than formation, finally reducing it to a low point which permits the yellow carotinoids to be seen. If no other masking pigment is present, such leaves become pure yellow or orange, like tulip-tree, willow and *sassafras*.

The other class of pigments, the anthocyanins, are dissolved in the cell sap. With the exception of a few purple-leaved or bronze-leaved plants, these pigments are also concealed by the more abundant chlorophyl, and show themselves only when it has been sufficiently broken down. At the same time, certain changes in the carbo-hydrate content of the leaves may cause an actual increase in the amount of anthocyanins present. Thus we get the strong reds and purples of sumac blackberry, sweet-gum, oaks, etc.

Trees like maples, which sometimes show a gorgeous mottling of yellows and reds, may have local patches of anthocyanins masking the carotinoid ground color. (Science, Vol. 76, No. 1971, Oct. 1932, p. 14 (Suppt.)).

The Brahman (Zebu) cross is a Hardy Type. According to an extract, the Proceedings for 1933 of the American Society of Animal Production contains a paper dealing with the growth of different types of cattle in Louisiana, including crosses with the Brahman (Zebu). The writers state that the Brahman is pre-eminently a grazing animal and makes good gains on coarse grasses. The Brahmans do not appear to suffer to the same extent from flies, mosquitoes and external and internal parasites. They also stand the heat better. Further, at the Louisiana Station no Brahman grades have died from bloating on clover, while losses among the breeds of British origin are sometimes severe. The authors state that the principal advantage of the Brahman lies in its capacity for making gains on grass alone, a quality that is of great importance on the coastal plains. (Agricultural Gazette, New South Wales, Vol. XLIV, Part II, November 1933).

Tobacco Crop and Potassic Fertilizers. Tobacco compared with other crops is a heavy feeder on potash, and as Anderson, Swanback and Street have shown—(55th Report, Connecticut Agricultural Experiment Station Bulletin 334) the presence of an ample supply of this element in the soil is important if a good quality cigar is to be obtained. Besides inducing characteristic starvation symptoms in the plant itself, the lack of potash renders the crop less resistant to drought and to certain types of disease. From the manufacturer's point of view also, an adequate potash content of the leaves is of great importance, for leaves deficient in this element will not come into "case" in damp weather after curing, that is, they remain brittle and difficult to handle owing to their lack of potash compounds, upon the hygroscopic properties of which the softening process depends. The fire-holding capacity of cured leaves is another property dependent on the potash present, but all the potassinm salts tested did not prove equally effective. In general, the Organic Salts were the most suitable for producing the incandescent type of combustion required for a good cigar. A reduction in the dressing of potassic fertilizer given was found to affect the quality of the tobacco produced long before any actual decrease in yield was obtained, an annual dressing of so much as 200 lb. per acre being required to produce the best results at the Connecticut Tobacco Substation at Windsor, U S. A. (Nature, Vol. 132 No. 3325 July 22nd, 1933).

Pneumatic Tyres for Bullock Carts. A year or two ago no one would have thought it possible that such a refinement as pneumatic tyres could be applied to bullock carts, and yet today it is an accomplished fact. Once more Dunlop is first in the field with perfected equipment which can be purchased at a reasonable cost. The development does not stop at conversion only, for the Allahabad Agricultural Institute has taken the initiative and designed an iron framed cart which, with a load of over three tons is easily pulled by two ordinary bullocks. The usual type of bullock cart with iron shod wheels can carry at the most 46 cwts. for which three and sometimes four good bullocks are required. There is a full range of sizes available and one of the important features of the equipment is the incorporation of roller bearings in the hubs, steel artillery wheels with well base rims being standard. The following are the practical advantages to be gained by the use of pneumatic tyres :—*Carts for Agricultural work.* (1) Ground impassable to iron tyred carts is easily traversed. (2) Loads 50 per cent, greater can be carried. (3) No ruts are made by the passage of the wheels. (4) Carts of lighter construction and larger capacity can be used. (5) A much lower loading line can be obtained, materially reducing the time and effort required to load and unload. (6) The cart itself lasts longer and wheel maintenance is negligible, the greasing of the hubs being necessary only once in six months. (7) More work can be done with fewer bullocks, carting costs and cost of bullock feed are reduced. *Carts Used for transportation purposes.* Similar advantages are obtained with vehicles used for road transport. (1) Much greater loads for the same tractive effort are possible. (2) Vehicles can proceed at a greater pace. (3) Bad roads can be negotiated with ease and the carts move silently and smoothly and can be easily manoeuvred. (4) There is no jolting and carts fitted with pneumatic tyres will last far longer than those fitted with iron tyred wheels. (5) Fragil loads are less liable to breakage, (Indian and Eastern Motors August 1933).

Madras Agricultural Department.

Summary of the Operations in 1932-33.

Retrenchment. The full effect of retrenchment has resulted in the loss of 8 gazetted officers, 24 upper and lower subordinates, 8 clerks, etc,. and 17 menials, which is a big toll on an young department like this.

Agricultural Education. Students at the Agricultural College, Coimbatore were levied tuition and lodging fees and the scholarships were reduced from Rs. 25/- to Rs. 20/-. There was a reduction in the number of applicants for admission. 40 students secured the B. Sc. Ag. degree. Facilities for post graduate study for M. Sc. were afforded at the Research Institute and Research Stations.

The middle school at Taliparamba was abolished and the school at Kalahasti could not be opened as the buildings were not ready. The middle school at Usilampatti maintained by the Madura District Board had a marked increase in the number of students.

Farm labourers' schools and classes for practical training in agriculture were maintained at some of the Research Stations.

Season. The general effect of the monsoon on the crops at several Agricultural Stations was adverse though in a few places and in respect of a few crops the yields were above normal.

Research—Chemistry. Research received adequate attention. The chemistry section made a systematic study of soils for their characteristics. The results obtained in the study of soil Nitrogen indicate that an adequate supply of organic matter is a very important factor in maintaining the nitrogen status of the soil and in controlling loss of nitrogen. The litter of *eri* silk worm was found to be as good as castor cake in analysis and in field experiments, its manurial value was even superior to groundnut cake when applied to *ragi* crop. Addition of very small quantities of copper sulphate or common salt rendered a mixture of night soil and village rubbish odourless and thus good manure was obtained. The study of the influence of manuring on the quality of the crop confirmed previous findings, in that grain raised with cattle manure or oil cake, possessed better nutritive value, than grain raised with 'no manner' or chemical manure. *Eri* silk worms fed with castor leaves from plots manured with cattle manure contributed to better growth and greater cocoon weight.

Botany. Besides collecting and preserving specimens at the Herbareum and supplying and exchanging material, the Botany section made economic studies on fodder grasses, the most common weeds and varieties of banana.

Crops. To suit the varying conditions of soil and climate of the different tracts of the presidency sub-stations for the study and improvement of crops are essential; but for the sake of economy, assistants trained at the Research Institute are posted to different existing farms to handle crops locally. Strains of irrigated white and yellow sorghums and dry yellow sorghums have been evolved at Coimbatore by the Millets Specialist and has passed the trial stage. The dull mid-ribbed sweet-stalked variety of sorghum was found to be superior in fodder value. At Nandyal, three strains of sorghum have given as high an yield as N. 23/10, and much higher than T-6, the present standard. Sorghum spacing trials are in progress at Nandyal and Hagari. Ragi (Eleusine) strain E. C. 593 has done well in different parts of the presidency. One strain of Tenai (Setaria) is ready for distribution.

Work on rice is done at Coimbatore as well as in sub-stations where both economic and agronomic research are conducted. A strain of Anai-Komban (Co. 8) has done well at Tinnevelly. Two more promising strains are in the trial stage. Eight strains are ready for release from Maruteru. Similarly new strains have completed their trial stage and are ready for distribution at Aduturai and Pattambi. In manurial trials, best results were obtained by applying Ammonium sulphate one month after planting at Maruteru and Pattambi and two months after planting at Coimbatore. Transplanting has given 25% increase over broadcasting. Dry ploughing of paddy lands had a deleterious effect on the crop at Samalkota.

In cotton three new cambodia strains were superior to Co. 2. One strain of *Karungauni* (546) was again superior to C. 7 and has done well in trial plots at Koilpatti. Experiments at Hagari showed that yellow factor in the flower war related to small bolls and early flowering, and that there was no relation between seed weight and lint weight. In rotation experiments, cotton after green manure, gave the highest yield. A new irrigation experiment to test the influence of irrigation on humidity and insect pests was started at Coimbatore. The various spacing trials confirm the common opinions that a higher seed rate should be used in fertile soils. In the Herbaceum scheme, financed by the Indian Central Cotton Committee, four lines have given hopes of being heavy bearers. In the Pempheres and Physiological scheme, experiments were in progress to tackle the pempheres problem. A study of different varieties revealed that Kidney and Nigerian cotton alone were found to be completely free from attack.

One strain of Bengal gram (Cicer) gave higher yields than local and was also highly wilt-resistant.

In groundnut trials, "Saloum" proved superior to local Maritius for the second time. Spacings of 6″ × 6″ for the bunch variety and 9″ × 9″ for the spreading variety proved most economical. The study of oil formation at different stages in the development of kernels led to interesting results. Studies on the root system and hybridization work with a view to evolve high-yielding short-duration varieties are in progress. Varietal studies and selection work were conducted on gingelly and castor also. In coconuts, manurial experiments, hybridization of different types, and investigations into the methods of selecting promising seedlings from the nursery, were initiated.

In potato, experiments on manures, spacing, planting cut and whole tubers, comparison of new seed with old seed, and spraying against *alternaria* were in progress at Nanjanad.

Investigations on pepper were continued at Taliparamba and on Chillies at Guntur. Cultivation of sugarcane was taken up in almost all the agricultural stations. At Anakapalle, experiments on irrigation, spacing, method of planting and wrapping, and at Samalkota, trench and bed planting, seed (sett) treatment, and spacing were in progress. In manurial trials, Ammonium sulphate was found to be very efficacious, and manure applied in three doses gave better results than if applied in a single dose or in two doses. In a rotation experiment at Palur, cane grown once in four years or five years gave good results, and cane grown in alternate years, was found to be detrimental to the soil.

Among fruit crops, plantain (Banana) received most attention. "Plantain figs" achieved a great success and the demand is growing. Increased attention is being given to fruit cultivation. A scheme of research financed by the Imperial Council of Agricultural Research will shortly be introduced.

Besides maintaining and improving the gardens at Ootacamund and Coonoor, new species of plants and trees were introduced. With a view to create new hybrids and varieties, a number of cross pollinations were effected between different varieties and species of ornamental plants.

Implements. A ball-bearing mhote-wheel manufactured by Messrs. P. S. G. & Sons, Charity Industrial Institute, Coimbatore, has been approved after trial, and is priced at Rs. 10—12—0. Several types of water lifts were under trial. Cooper plough No. 11 was modified with a view to ensure economy in initial cost.

Livestock. The experiment on breeding half-bred to half-bred which has been going on since 1919 has been closed during the year. The results so far obtained go to show that this method would not lead to any success. There was deterioration in all respects in the third and fourth generations, when compared to the second. Work on Ongole herd at Hosur was decided to be discontinued.

Work on Scindi and Kangayam cattle is in progress. Different breeds of poultry are under trial. While white leghorns are the heaviest producers of eggs, the Black Minorcas lay the largest egg.

Entomology. Among the special investigations on which work was continued during the year may be mentioned the rice stem-borer and grass-hopper, cocoanut beetles, thrips on chillies, hairy caterpillar of dry crops, cotton boll worms, and the black-headed catterpillar of cocoanut. An intensive study of some important insect pests of fruit trees and vegetables was started during the year. Information has been gathered on the periods of emergence of such pests as rice stem-borer, cockchafers, groundnut *surul*, ragi white borer, and hairy caterpillar moths. The Apiary started last year has taken a definite shape. Research on the various aspects of bee-keeping was commenced and apprentices were trained. The rearing of *eri* silk worms was started. The bionomics of the worm and the economics of the work as a cottage industry were studied.

Mycology. Studies of the disease known as "foot rot" of rice and treatment for the same were continued. Good results have been obtained by treating seed with different chemicals and hot water. Eight, out of twenty varieties of sugarcane tried, proved highly resistant to mosaic. Studies on wilt on plantain and red gram, betel wine leaf spot and fruit rot diseases are in progress.

Demonstration. The number of trial plots and demonstration plots conducted during the period was 130 and 2733 respectively. The ryots' demand for the services of the demonstrator is on the increase. 168 exhibitions were held and 500 lectures on agricultural subjects were delivered during village fairs, festivals, conferences, etc. The three motor van exhibition units continued their itinerary in the presidency and worked in co-operation with the Veterinary, Fisheries, Industries and Public Health Departments.

Propaganda and demonstrations on the reduction of seed rate in paddy and sugarcane, line planting, trenching, wide spacing and using "short crop" for planting in sugarcane, and drill sowing of dry crops in the south, were in progress. Green manure supplemented by bone meal or superphosphate for paddy, and oil cake in conjunction with ammonium sulphate for sugarcane were recommended as before. Manuring of fruit trees received attention. Distribution of improved strains evolved by crop specialists has all along been one of the main lines of activity of the department. Demonstrations with improved implements and obtaining the same for ryots, forms another main activity of the department 6800 demonstrations were held and about 1700 implements consisting of sugarcane mills, chaff cutters, mhote wheels, iron ploughs, bund-formers and other tillage implements were purchased by the ryots through the department.

The number of breeding bulls maintained under the premium scheme was 72. Besides these there were 127 bulls at stud, including those at research stations, Veterinary hospitals and Jails. Several hundreds of eggs for setting, as well as chicks of good breeds were supplied to the ryots.

Loans amounting to Rs. 1,762—8—0 were granted to ryots for the purchase of implements.

The number of manure pits maintained at the suggestion of the department, amounted to 9 962 besides which there were 2,378 dry earth sheds, 96 byres and 47 loose boxes. 617 compost pits were made during the year.

The demand for *pillipesra (Phaseolus trilobus)* for green manure in the Godavari Delta was great and 1,700 tons were produced for distribution there. In the Trichinopoly and Tanjore Districts 20 tons of wild indigo seed were sold by the Department and 100 tons were purchased by ryots through Co-operative Societies and private agencies. The total quantity of all the green manure seed distributed to ryots amounted to 380 tons.

There was a decline in the use of oil cakes and artificial fertilizers except in the second circle due to general economic depression. In this tract 2260 lb. of bone meal was sold by the Department, besides the large sales made by the fertilizer firms direct.

Use of sulphur dust against sorghum smut was demonstrated with success. The prickly pear is fast disappearing due to the depredations of the cochineal insect recently introduced. In the fourth circle 4000 cocoanut trees were saved from damage by *Nephantis serinopa*, by the introduction of parasites. Timely control measures were taken against slug catterpillar of coconuts in Malabar. Mildew on grapes in the fifth circle was kept in check by the timely spraying of bordeaux mixture.

Large quantities of seeds of paddy, cotton and green manure, were distributed through various co-operative societies. Jaggery, cotton and groundnut were sold through Co-operative concerns. Two societies in the sixth circle purchased bulls for breeding.

Legislation. The Cotton Ginning and Pressing Factories Act, and the Cotton Transport Act, continued to be in force during the year. There were 556 ginning factories and 67 pressing factories of which about 100 of the former and six of the latter did not operate. The absence of restriction on the movement of cotton by road and river continues with the result that the object of the act is not fully attained. The Cotton Control Act passed at the close of last year, was not strictly enforced during the year as seed for sowing had been obtained by ryots before the provisions of the act and rules were widely published and circulated. A bill to provide for the establishment and the better regulation of markets for commercial crops was passed by the Legislative Council.

The Agricultural Pests and Diseases Act was in force during the year in respect of insects and pests affecting cotton (stem weevil and pink boll worm), groundnut (red hairy caterpillar—*Amsacta albistriga)* and palmyra (bud rot), and the eradication of water hyacinth.

Publications. Seventeen leaflets, two notes and two bulletins were published by the department. A book on South Indian Weeds was also published. 59,860 copies of the Villagers' Calendar were printed in the different languages.

The expenditure of the department for the year was Rs. 16,90,668 as against Rs. 17,73,165 of the previous year. This is due to reduction of staff, emergency cut in salaries and allowances and economy in contingent expenditure.

The report concludes with a projected programme of the main lines of work for the succeeding year.

M. A. S.

Crop and Trade Reports.

Cotton Crop—Madras 1933-34. Third Report. The average of the areas under cotton in the Madras Presidency during the five years ending 1931-32 has represented 9 per cent. of the total area under cotton in India. The area under cotton up to the 25th November 1933 is estimated at 1,762,300 acres. When compared with the area of 1,727,600 acres estimated for the corresponding period of last year, it reveals an increase of two per cent. The increase in area occurs in all the important districts outside the Circars, Salem and Ramnad. The area in the Deccan has risen from 778,000 acres to 832,000 acres and the increase is marked in Kurnool and Bellary. The area under irrigated cotton, mainly cambodia is estimated at 165,400 acres as against 156,300 acres in the corresponding period of last year, an increase of about six per cent.

2. Pickings of the early sown crop in the Deccan are in progress and fairly normal yields are expected. The condition of the main crop throughout the Presidency is satisfactory. But in the eastern borders of the Koilpatti taluk of the Tinnevelly District, the newly sown crop has been damaged by heavy rains and floods. Normal yields are expected in all the districts except in Ganjam and Vizagapatam where the yields are expected to be slightly below normal. The seasonal factor for the Presidency works out to 100% of the average as against 99% in the previous year. On this basis, the total yield is estimated at 374,500 bales of 400 lbs. lint as against 361,300 bales of last year, an increase of 3·7%. The crop is young and it is too early to estimate the yield with any degree of accuracy.

3. The estimated area and yield under the several varieties are given below:-

Area in hundreds of acres i.e. 00 being omitted, yield in hundreds of bales of 100 lb. lint, i.e. 00 being omitted.

Variety.	Area 1st April to 25th November.		Corresponding yield.	
	1933.	1932.	1933.	1932.
(1)	(2)	(3)	(4)	(5)
	Acs.	Acs.	Bales.	Bales.
Irrigated Cambodia	1,577	1,456	986	911
Dry Cambodia	1,173	1,170	250	247
Total, Cambodia	2,750	2,626	1,236	1,158
Karunganni in Coimbatore	1,027	930	231	215
Uppam in the Central Districts	247	300	41	48
Nadam and Bourbon	308	397	16	20
Total, Salems	1,582	1,627	288	283
Tinnevellies (a)	3,680	3,662	948	944
Northerns and Westerns	8,320	7,780	1,040	942
Cocanadas	1,141	1,393	215	262
Others	150	188	18	24

(a) Includes Uppam, Karunganni and mixed country cotton in the South.

4. The local cotton trade is not generally active at this time of the year. The wholesale price of cotton lint per imperial maund of 82 2/7 lb. as reported from important markets towards the close of November 1933, was about Rs. 15-3-0 for Cocanadas, Rs. 15—10—0 for red northerns, Rs. 16—8—0 for white northerns. Rs. 14—1—0 for westerns, Rs. 22—4—0 for cambodia, Rs. 20—14—0 for Coimbatore Karunganni, Rs. 19—3—0 for Tinnevelly Karunganni, Rs. 17—0—0 for Nadam and Rs. 17—14—0 for Tinnevelly cotton When compared with the prices in the previous month, these prices reveal a fall of 3 to 8 per cent. for all varieties of cotton except Northerns, Westerns and Cocanadas. The prices of Northerns are stationary and the other two varieties show a rise of about 2 and 3 per cent. respectively.

Sugarcane crop—Madras—1933-34. The sugarcane crop was affected to some extent by heavy rains and floods in parts of Ganjam, by drought in Chittoor and North Arcot and by the attack of insects in South Arcot. The condition of the crop is satisfactory in the other districts and the yield is expected to be normal if the season continues to be favourable.

2. The wholesale price of jaggery per Imperial maund of 82 2/7 lb. as reported from important markets towards the close of November 1933 was Rs. 5—5—0 in Nandyal, Rs. 5—2—0 in Erode, Rs. 4—13—0 in Bellary. Rs. 4—8—0 in Bezwada and Rs. 4—5—0 in Guntur. It ranged from Rs. 3—6—0 to Rs 4—2—0 in the other important stations. When compared with the prices of the previous month, these prices reveal a rise of 24 per cent. in Bellary and 3 to 8 per cent.

in Ellore, Bezwada, Cuddapah and Trichinopoly and a fall of 2 per cent. in Guntur; the prices are stationary in the other stations.

Paddy crop—Madras 1933-34—Second Report The average of the areas under paddy in the Madras Presidency during the five years ending 1931-32, has represented 13·3 per cent. of the total area under paddy in India.

2. The area sown with paddy up to the 25th November 1933 is estimated at 10,491,000 acres. When compared with the area of 10,312,000 acres estimated for the corresponding period of the previous year, it reveals an increase of 1·7 per cent

3. The increase in area occurs in Vizagapatam, Anantapur, Cuddapah, Salem, Coimbatore, Trichinopoly, the South (Ramnad excepted), Malabar and the Nilgiris. This increase has been partly set off by a reduction in area in most of the other districts.

4. The first crop has been harvested throughout the Presidency. Normal yields have been reported from all districts except Godavari (East and West), Chingleput, South Arcot, Chittoor, North Arcot, Trichinopoly, Tanjore, Tinnevelly and Malabar. The crop was adversely affected to some extent by the heavy rains of October in parts of East Godavari and West Godavari and by the attack of insects in parts of Trichinopoly, Tanjore and Malabar. It was effected by drought in parts of the districts of Chingleput, South Arcot, Chittoor and North Arcot.

The seasonal factor for the Presidency works out at 97% of the average as against 99% in the corresponding period of the previous year.

5. The wholesale price of paddy per imperial maund of 82 2/7 lb. as reported from important markets towards the close of November was Rs. 2—14—0 in Nandyal, Rs. 2—2—0 in Cuddapah and Nellore, Rs. 2—0—0 in Vellore and Tinnevelly and ranged from Rs. 1—7—0 to Rs. 1—14—0 in the other markets. When compared with the prices reported for October 1933, these prices are stationary in Berhampur, Vizianagaram, Rajahmundry, Masulipatam, Nellore, Cuddalore, Vellore, Kumbakonam and Madura. They have risen from 3 to 11 per cent. in Cocanada, Rajahmundry, Nandyal, Negapatam, Tinnevelly and Cochin and are lower by 2 to 10 per cent. in the other markets.

THE INDIAN SCIENCE CONGRESS

The twenty first annual meeting of the Indian Science Congress will be held this year from the 2nd to the 8th of January 1934, at the Royal Institute of Science and University Buildings, Bombay. His Excellency Lord Brabourne G. C. I. E. Governor of Bombay will open the session, after which Dr. Meghnad Saha D. Sc., F. R. S., F. A. S. B., University Professor of Physics, the President of this year's Congress, will deliver his address.

The following are the sectional presidents:—

1.	*Agriculture.*	Dr. S. S. Nehru, M. A., Ph. D., I. C. S., Allahabad.
2.	*Mathematics and Physics.*	Dr. S. K. Mitra, D. Sc. (Cal. and Paris) Khaira Professor of Physics, Calcutta University.
3.	*Chemistry.*	Dr. H. B. Dunnicliff, M. A., Sc. D., F. I. C., I. E. S., Professor of Chemistry, Government College, Lahore.
4.	*Zoology.*	Prof. P. R. Awati, B. A. (Cantab) D. I. C., I. E. S., Professor of Zoology, Royal Institute of Science, Bombay.
5.	*Botany*	Prof. R. H. Dastur, M. Sc., Professor of Botany, Royal Institute of Science, Bombay.
6.	*Geology.*	Prof. K. K. Mathur, B. Sc. (Hons.) (Lond.) A. R. S. M., Professor of Geology, Hindu University, Benares.

7. *Medical and Veterinary.*	Lt-Colonel S. S. Sokhey, M. A., D. Sc., D. T. M. & H., I. M. S. Director, Haffkine Institute, Bombay.
8. *Anthropology.*	Rai Bahadur Ramprasad Chanda, B. A., F. A. S. B., Late Superintendent, Archaelogical Survey of India, Calcutta.
9. *Psychology.*	Manmathanath Banerji Esq. M. Sc., B. L., Lecturer in Physiological and Experimental Psychology, University College of Science, Calcutta.

In addition to the sectional meetings as usual, a number of symposia on different subjects, in which scientists from all over the country will take part, will be a feature of this year's Congress. The following symposia have been tabled in the programme (1) Neutrous, Position and Cosmic Rays. (2) Chemical Researches in India and their bearing on Technical Problems. (3) Recent work in Plant Genetics in India. (4) Recent advances in colloid chemistry. The following popular lectures will also be delivered (1) "The expanding Universe" by Prof A. C. Bunnerjee, I. E. S. (2) "Recent Agricultural Developments in Europe and Canada" by Dr. S. S. Nehru (3) "Is Darwinism dead"? by Prof. R. H. Dastur, (4) "Electrical Transmission of Pictures' by Mr. S. R. Kantebut and (5) "Physiology and Human Welfare" by Major S. L Bhatia.

College News & Notes.

Games. *The Victory Cup Tournament.* In the first round class ii met class i, at cricket, and declared their first innings for 6 wickets, Narasinga Rao making 60 and B. S. Murthy 28, Ramanatha Rao of class i taking three wickets for 28. Class i were all out for 54, Ramanatha Rao making 16, Narasinga Rao and B. S. Murthy taking 3 and 4 wickets respectively for 18 runs each. The winners met class iii who were disposed off for 73 runs, Ananda knocking up 29 and the bowling honours going to Narasinga Rao with 7 wickets for 25. Class ii replied with 114 runs, Narasinga Rao contributing 30 (retired) and B. S. Murthy 27, the bowling honours being shared by Ananda with 4 wickets for 45 and Sahadevan with 3 for 38.

In football class iii lost to class i by one goal to two, but in their turn, class i in their next encounter met their reverse at the hands of claas ii, who won by a comfortable margin of 5 goals to one.

Hockey was not played to a finish, Class iii beating class ii by 2 goals to 1 but the next engagement between class iii and class i not coming off. The Victory Cup has thus been won by class ii this year.

Tennis Handicap Doubles Tournament The finals of the above tournament came off between Narasinga Rao and Venkata Sastry and Money Joseph and Manavalan. The match was very keenly contested, and after two draws, the former pair won finally winning 3 out of 4 sets, the scores being -6, 6-3, 6-3, 7-5.

Though these tournaments served to keep up some lively interest in games during the month, there has been a considerable lull in athletic activities. due to the terminal examinations, for which students were busy preparing.

A trip to Maruthamalai. Estate residents with families, organised a trip to Maruthamalai on Sunday the 10th when *Abishegam* was performed for *God Subrahmania*. The usual *Dhanurmasa puja* and *Bajana* done by the Hindu residents of the estate have begun in full swing.

Visitors. Dr. P S. Hudson B. Sc., Ph. D., Assistant Director of the Imperial Bureau of Plant Genetics, Cambridge, Mr. P H. Rama Reddy, Secretary, Indian Central Cotton Committee and Mr. R. C. Broadfoot, Headquarters Deputy Director of Agriculture. Madras, visited the station during the month.

Association of Economic Biologists. Under the auspices of the above association, Dr. P. S. Hudson gave a lecture on the 13th, on "The Origin of cultivated Plants".

Weather Review (NOVEMBER—1933)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	2·8	- 1·2	54·6
	Berhampore *	0·9	- 5 9	59·0
	Calingapatam	0·8	- 3·1	43·5
	Vizagapatam	2·4	- 1·3	29·3
	Anakapalli *	1·5	- 3·1	46·4
	Samalkota *	1·1	- 3·1	32·8
	Cocanada	1·4	- 4·0	32·5
	Maruteru *	3·4	- 1 8	42·5
	Masulipatam	4·8	- 0·9	41·8
	Guntur *	8·5	+ 4·9	33·4
Ceded Dists.	Kurnool	3·0	+ 1·8	27·0
	Nandyal *	2·3	+ 1·0	32·3
	Hagari *	1·1	- 1·2	25·5
	Bellary	1·4	-- 0·8	36·5
	Cuddapah	2·3	-- 1·3	22·6
	Anantapur	0·9	...	27·0
Carnatic	Nellore	7·5	- 3·7	45·6
	Madras	5 8	- 8·5	24·7
	Palakuppam *	4 1	- 7·7	29·5
	Palur *	5·0	- 8·2	36·2
	Cuddalore	6·0	- 9·1	32·0
Central	Vellore	1·6	- 5·3	20·7
	Salem	2·1	- 1·6	45·2
	Coimbatore	2·5	- 1·3	26·5
	Coimbatore Res. Inst. *	3·3	- 1·0	29·6
	Trichinopoly	4·1	- 1·5	34·7

Division	Station	Actual for month	Departure from normal	Total since January 1st
South	Negapatam	12·7	- 5·0	36·0
	Aduthurai *	5·4	- 5·1	25·5
	Madura	6·9	+ 2·0	35·7
	Pamban	7·0	- 5·0	20·2
	Koilpatti *	7·4	+ 0·2	27·0
	Palamkottah	11·4	+ 4·0	33·9
West Coast	Trivandrum	5·8	- 0·8	118·7
	Cochin	6·7	+ 0·2	154·9
	Pattambi *	1·7	- 2·4	137·9
	Calicut	2·3	- 3·1	167·4
	Taliparamba *	1·9	- 2·5	189·0
	Kasargode *	0·4	- 4·0	159·9
	Nileshwar *	0·4	- 2·6	167·4
	Mangalore	2·0	- 1·1	160·9
Mysore and Coorg	Chitaldrug	0·3	- 2 0	36·3
	Bangalore	0·2	- 2·7	39·1
	Mysore	0·0	- 2·5	37·7
	Mercara	1·2	- 2·0	159·7
Hills.	Kodaikanal	7·4	—0 8	69·9
	Coonoor *			
	Kallar *	16·3	+ 4·7	82·6
	Ootacamund *	3·1	—1·5	61·7
	Nanjanad *	2·5	—1·6	54·8
Central	Hosur cattle farm *	0·1	0 0	26·7

* Meteorological stations of the Agricultural Department.

Summary of weather conditions. In connection with the passage of a low pressure wave into the Andaman Sea from the East across Tenasserim, a shallow depression was formed near Latitude 14° N and Longitude 97° E by the third morning without appreciable movement or intensification. Depression persisted there till the 5th when it weakened into a low pressure area. This low pressure area moved slowly westwards and was concentrating into a depression in the South-West Bay of Bengal with the consequent strengthening of the North-East monsoon in the South of the Bay of Bengal.

The low pressure area moved North-Westwards and passed out South-East of the Arabian Sea by the 10th morning It caused unsettled weather in the South-East of the Arabian Sea between the 10th and 13th and became unimportant thereafter. Widespread locally heavy rain occurred in South-East Madras on the 8th, 9th and 10th, the rainfall being specially heavy in the Tinnevelly District. The rainfall also extended into Malabar, Mysore, South Konkan and West Deccan.

The North-East monsoon strengthened in the South-East Bay of Bengal after the 10th and a depression formed in the neighbourhood of Nicobar by the 14th morning moving slowly west, northwestwards. This depression intensified into a cyclone which centered near latitude 10° N and longitude 90° E on the 15th and was sevre on the 17th. It crossed the coast between Nellore and Masulipatam early morning on the 18th and weakening, thereafter, lay as a depression over Madras Deccan at 8 hours. The depression continued to move North-Westwards but weakened gradually and a low pressure passed out into the East Arabian Sea across Konkan coast by the 18th morning. The weather was slightly disturbed off Konkan on the 19th. Fairly widespread rain occured during the movement being locally heavy on North Madras Coast and in Madras Deccan on 17th.

The Western disturbance was of more frequent occurrence throughout the month, as many as four, having occurred during this period within short intervals. But these disturbances were of short duration and of low intensity. These passed over Kashmir, Baluchistan, Northwest Frontier and recurved eastwards through extreme north. A few falls of rain in Baluchistan, nearly general rain in east and north Punjab, local falls in the North-west Frontier Province, and showers of rain or snow in Kashmir were the marked results of these disturbances.

A few scattered showers were experienced in South-east Madras during the close of the month with indications for the weather tending to become dry elsewhere.

The minimum temperature remained below normal in the Deccan and central parts of the country during a third of the month followed by a spell of continued showers with rise in humidity and subsequently tending to return to normal temperature with dry weather conditions.

The rainfall was below normal throughout the presidency except in places where notable excesses were recorded. The chief falls were Melur (Madura) 7·6'' (4th), Negapatam 4·5'' (9th), Palamkottah 8·0'' (10th), Kurinjipadi (S. Arcot) 7·0'' (9th), Chidambaram (S. Arcot) 6·7'' (9th), Tinnevelly Town 9·9'' (10th), Tenkasi (Tinnevelly) 8·3'' (10th), Kayatar (Tinnevelly) 7·1'' (10th), Sivakasi (Ramnad) 5·7'' (10th), Srivilliputtur (Ramnad) 5·4'' (10th), Srivaikuntam (Tinnevelly) 5·3'' (10th), Nellore 3·7'' (18th).

Weather Report of the Research Institute Observatory: Report No. 11/33.

Absolute maximum in shade	88·5° F
Absolute minimum in shade	62·2° F
Mean maximum in shade	84·4° F
Departure from normal	—0·4° F
Mean minimum in shade	68·2° F
Departure from normal	0·0
Rainfall during the month	3.33''
Departure from normal	—0·96''
Heaviest fall in 24 hours	1·41''
Number of rainy days	4
Mean daily wind velocity	2·3 M P. H.
Mean 8 hours wind velocity	3·2 M. P. H
Mean humidity	83·3%
Total hours of bright sunshine	225·6
Mean daily hours of bright sunshine	7·5

General weather conditions. The pressure was steady throughout the month with a slight rise towards the second fortnight. The monsoon was not active during the month and practically disappeared after the second week. The rainfall was below normal and a fall of 1·41 inches was recorded on the 6th. The humidity was in excess. The maximum and minimum temperatures were below normal, the latter half of the month being chill during the nights.

C. V. R. & T. S. L.

Departmental Notifications.

First Circle. S. Ramaswamy Iyer, Botany Assistant, l. a. p. for 15 days from 6—11—33 with permission to perfix Sunday 5—11—33 D. Hanumantha Rao, A. D. Razole l a. p. for 15 days on m. c. from 1—11—33. V. Butchiraju, A. D. Ramachandrapur will be in additional charge of the Razole taluk during the period or until further orders. V. Krishnaswamy Rao, A. D. Sompet leave for 3 months on m. c. on full average pay from 15—10—33; the a. d. Narasaraopet will again be in charge of the Sompet subcircle in addition to that of his own. R. Vasudeva Rao, F. M. l. a. p. for 1 month and 9 days from 13—11—33 to 21—12—33 with permission to perfix Sunday 12th November and suffix X'mas and New Year holidays. D. Hanumantha Rao, A. D. Razole, l. a. p. on m. c. for 15 days from 16—11—33 in continuation of 15 days leave already granted from 1—11—33. The existing arrangement will continue during this period. S. Ramaswamy Iyer, Botany Assistant, extension of leave on m. c. for 3 weeks from 21—11—33 in continuation of leave already granted. T. Seshachalam Naidu, A. D. Tuni, l. a. p. for 3 weeks from 3—12—33 with permission to suffix X'mas and New Year holidays; A. Rammohan Rao, A. D. Peddapur will be in additional charge of Tuni sub-circle during the period or until further orders. M. L. Narayana Reddi, A. F. M. A. R. S. Samalkota, l. a. p. for 1 day on 4—12—33 with permission to avail Sunday the 3rd. N. Ramadoss, A. D. Cocanada on leave extension of l. a. p. for 15 days with permission to affix X'mas and New Year Holidays in continuation of leave already granted; the existing arrangements will continue during the period or until further orders. **Second Circle.** J. Suryanarayana, A. D. Vinukonda, extension of l. a. p. for 3 days from 15—11—33 with permission to avail of the holiday on 18-11-33 and 19-11-33 in continuation of the leave already granted. D. Bapayya, A. D. Guntur will continue to be in charge during the above period in addition to his own. T. Narayana Rao, Millet Assistant, extension of l. a. p for 3 weeks on m. c. from 1st to 21—11—33 in continuation of leave already granted. P. Satyanarayana, A. A. D. Kaikalur, l. a. p. on m c. for 2 months from 1—12—33. **Third Circle.** A. Krishnaswamy Ayyar, A. D. Koilkuntla l a. p. for 1 month sanctioned already is cancelled. P. Subramaniam, A. D. Gooty, extension of l. a. p. on m. c. for 6 weeks in continuation of leave already granted; A. D. Guntakal will be in additional charge of the Gooty sub-circle during this period or until further orders. L. Nilakantan, Cotton Assistant, Nandyal, l. a. p. for [illegible] days from 18—11—33 with permission to avail the holidays on 18—11—33 and 19—11—33. N. Kesava Ayyangar, Cotton Assistant, Nagari, l. a. p. for [illegible] days from 4—12—33, with permission to avail the holidays on 3—12—33, and the X'mas and New Year holidays M. Somayya, F. M. A. R. S. Nandyal l. a. p. for 20 days from 2—12—33 with permission to avail the X'mas and New Year holidays. **Fourth Circle.** K. S. Krishnamurthi Ayyar, A. D. Cuddalore l. a. p. for 3 days 27, 28 and 29—11—33 with permission to avail Sunday 26th. C. S. Krishnaswamy Ayyar, F. M. A. R. S. Palur l. a. p. for 20 days from 20—11—33 to 9—12—33 with permission to perfix and suffix holidays on 19th November and 10—12—33. K. P. [illegible] Menon will be in charge of the Farm during this period. E. N. Rangaswami Ayyangar, A. F. M. Kalahasti l. a. p. for 1 month from 15—12—33. **Fifth Circle.** A. Vasudasan, A. D. Tanjore, l. a. p. for 2 months in continuation of the leave already granted. **Sixth Circle.** M. C. Menon, A. D. Ambasamudram l. a. p. for 2 months from [illegible] December 33 or date of relief. S. Butchi Raju, A. A. D. on leave is posted to Ambasamudram in relief of M. C. Menon. **Seventh Circle.** K. Govindan Nambiar, A. D. [illegible], l. a. p. for 13 days from 13—11—33 to 25—11—33 with permission to prefix and suffix Sundays on 12th and 26th. K. Vasudeva [illegible], A. D. Puttur, l. a. p. for [illegible] weeks from 3—1—34 with permission to perfix X'mas and New Year holidays. K. M. Jacob, F. M. A. R. S. Taliparamba, l. a. p. for 14 days from 1 to from 27-5-33. K. W. Chakrapani Marar from II grade to I grade; K. Ramanuja Acharya from III grade to II grade. The lien of Mr. V. K. Subramania Mudaliar, Temporary Superintendent, A. R. S. Nanjanad on his permanent appointment in the Science Section, IV Grade is suspended under Fundamental Rule 13 and the following provisionally substantive appointments are ordered—to take effect from 1-6-33. S. M. Kalyanarama Ayyar, Assistant in Cotton from V grade to IV grade. M. Venkoba Rao, probationer in the Cotton Section to be Assistant in the same Section. The following promotions are ordered in the Lower subordinate service with effect from 13-4-33 G. R. Venkatachalapathi Raju and K. Balaji Rao from IV to III grade. A Venkoba Achar and S. P. Fernando from V to IV grade. C. Vijiaraghava Acharya, Assistant, Millets Section l. a. p. for 13 days from 9-12-33 with permission to suffix X'mas and New Year holidays. On the expiry of his leave he should rejoin duty at the A. R. S. Hagari. M. J. David whose officiating appointment as Upper Subordinate, Agricultural Section, terminated on 5-12-33 will continue to officiate from 6-12-33 till further orders in one of the temporary posts sanctioned in G. O. No. 329 Mis. Dev. dated 15-3-33. M. J. David will continue to work in the V circle. T. K. Mukundan, whose officiating appointment as Upper Subordinate, Agricultural Section terminated on 19-12-33 will continue to officiate from 20-12-33 till 5-2-34 vice M. C. Menon, A. D. on leave. T. K. Mukundan will continue to work in the IV circle.

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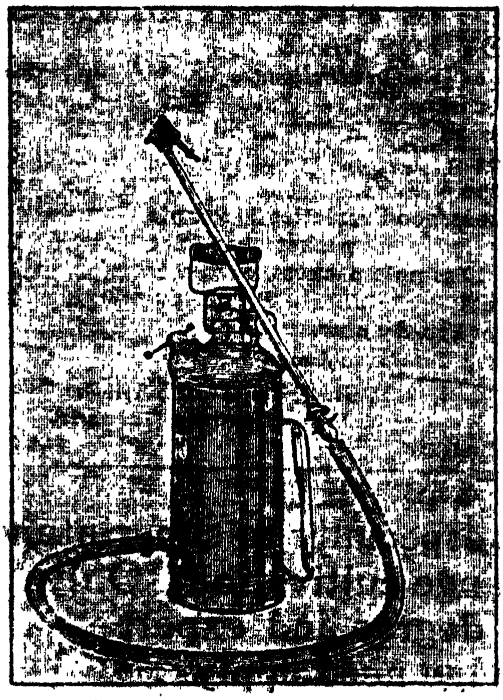

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